Industry & WELDING

OCTOBER / 1958

WELDING MANAGEMENT • PRODUCTION • ENGINEERING

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Joining the Special Alloys

STAINLESS STEELS · ALUMINUM · MAGNESIUM

STAINLESS STEELS · TITANIUM · MAGNESIUM

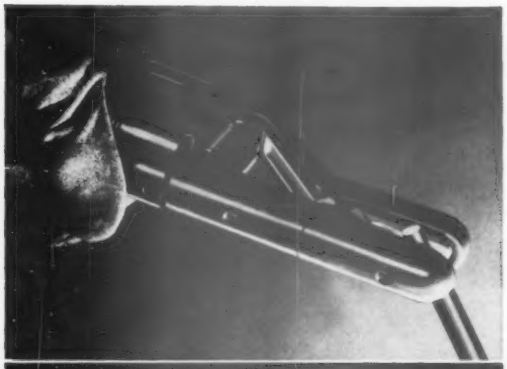
AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE / 20TH YEAR OF PUBLICATION

PREVIEW ISSUE

A New Size For INDUSTRY & WELDING page 5

It's Metal Show Time page 120

JACKSON for ARC WELDING



Insulated Copper Alloy Holders have greatest strength, hardness and conductivity. Jackson insulators have highest heat and impact resistance. Choose them where greater duty cycles are called for.

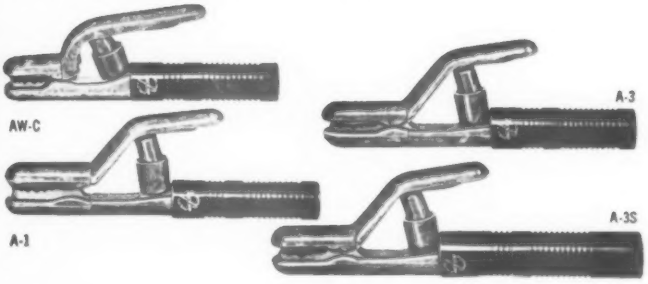
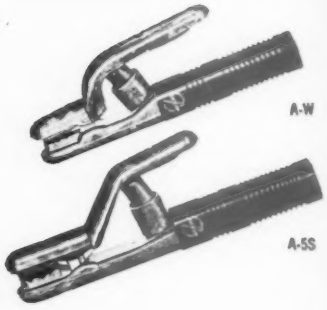


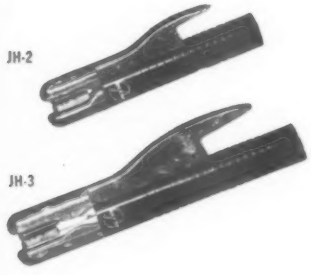
Table shows duty cycles possible with Jackson Insulated Copper Alloy Holders, using electrodes and cables shown.

Holder Class	Model	Electrode	Amps & Cable	Amps & Cable	Duty Cycle
Small	AW-C	7/32"	250—No. 1	300—1/0	50%
Medium	A-1	1/4"	300—1/0	350—2/0	50%
Large	A-3	3/8"	375—2/0	450—3/0	65%
Heavy-Duty	A-3S	3/8"	500—4/0		80%



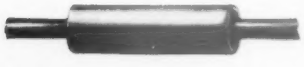
Featherlight medium class model A-W takes electrodes through 1/4" at 300 amps, weighs 14 oz. Featherlight larger model A-5S has wider tong and wider handle, takes electrodes through 5/16" at 400 amps.

Featherlight Holders have tongs of aluminum alloy, replaceable jaws of high-copper alloy. Excellent all-purpose holders, each within its rated capacity. Cable connection must be made mechanically.



Featherlight and streamlined, small class JH-2 takes electrodes through 5/32" at 200 amps, weighs 9 1/2 oz. Medium class JH-3 takes electrodes through 1/4" at 300 amps.

'Quik-Trik' Cable Connectors 2/0-R and 4/0-R have neoprene rubber insulators with tapered ends to stretch over cable snugly. They lock out moisture and dirt, don't catch against obstructions.



Cable Splicers for permanent connections. Copper alloy with hard fiber insulators.

Cable Lugs of cast copper alloy, 180 and 45 degrees.

Jackson Ground Clamps, Cable Connectors, Splicers and Lugs are available in three sizes:

MODEL	CABLE SIZE	CABLE CONNECTION	CAPACITY
No. 1	4 thru 1/0	Mechanical, soldered, or brazed	300 amps
2/0—R* and 2/0	1/0 and 2/0	Mechanical, soldered, or brazed	500 amps
4/0—R* and 4/0	3/0 and 4/0	Soldered or brazed only	500 amps

*Cable Connectors only

Jackson Ground Clamps give broad metal-to-metal contact. They also fit the hand, go easy on, easy off. Angled socket reduces strain on cable, allows wire fastening for extra support of the cable.

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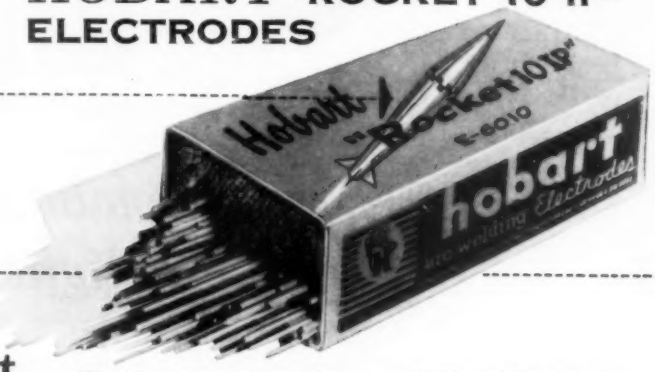

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Hobart's new DC Rectifier's unique design and exceptionally smooth arc action of "Rocket 10 IP" electrodes are the perfect combination. But first let's look at the advantages you gain through Hobart direct current welding:

1. DC can be used with all the latest types of electrodes — whether designed for AC or DC welding.
2. DC is easy to handle on out of position welding.
3. DC welding permits polarity flexibility which allows the use of specially designed, high speed welding electrodes. Some of the most popular electrodes used, where DC welding is preferred, are E-6010, E-6012, hard-facing electrodes, aluminum electrodes, and carbon electrodes.
4. DC welding allows the use of the Inert Gas process without the need for high frequency current.

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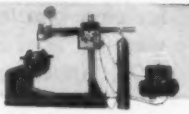

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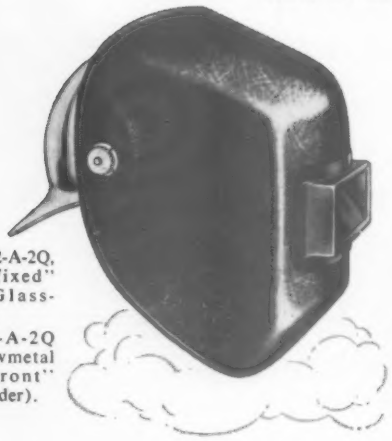

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3 oz. LIGHTER

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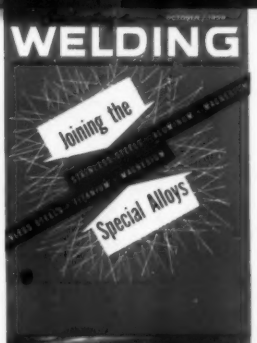

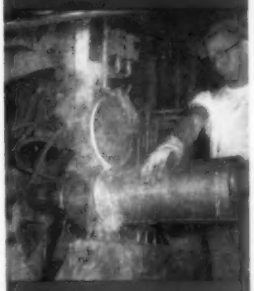

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READERS' GUIDE

October 1958 *volume* 31 *number* 10

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Aluminum's good strength-to-weight ratio and corrosion-resistance make it a natural for use in highway bridges.

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You can learn a lot by studying the techniques used to get "perfect welds" in stainless piping for the Navy's U.S.S. Tullibee.

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Combine the lightness and good heat conductivity of aluminum with stainless steel's heat- and corrosion-resistance.

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High heat and great speed of stored energy process joins steel studs to chrome-plate trim without damaging plated surface.

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Here's a way to eliminate locked-up stresses from butt welds and make them flush with the base metal in one operation.

78 **FLAME CUTTING SMALL PARTS SAVES $6,700**
Operating time was cut up to 511 percent when Thew Shovel used flame cutting to make small-piece multiple parts.

81 **MECHANIZED SURFACING OXY-ACETYLENE**
Porosity, cracking and rough surfaces were eliminated when a mechanized surfacing set-up replaced a manual one.

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A new plate handling system cuts handling time by 96 percent and saves 50 percent storage space.

94 **MOTORIZED FLUXING OF FLANGED PARTS**
Mechanized set-up fluxes one part every 8 seconds.

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A PREVIEW OF THE NEW LOOK FOR *Industry &* WELDING

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As EARLY as World War I, welding had demonstrated its production value in limited metalworking applications. It struggled without definition through the 1920's. Born in 1930, INDUSTRY & WELDING provided direction by which this technology could grow. It presented practical problems and workable solutions and has promoted new welded designs in all segments of industry. In so doing it helped make welding a valuable tool throughout industry. Today, welding is more widely used than any other metal working process.

As welding's role has expanded, INDUSTRY & WELDING's responsibility has called for expansion. WELDING ILLUSTRATED was created in 1952 to extend specialized information service across all industries. Together, these magazines provide the mass coverage required by so universal a subject and do so with a combined circulation of over 114,000 copies.

A third contribution to the literature of welding technology was introduced early in 1958. THE WELDING DIRECTORY filled an important need and received immediate praise throughout the welding industry. This biennial volume is the first complete engineering reference and source book for all welding equipment and supplies.

With INDUSTRY & WELDING, The Industrial Publishing Corporation came into being. Its basic publishing premise in 1930—as it is today—was simply this: A specialized magazine has a duty to cover its field comprehensively, authoritatively and, above all, readably. An editor's first responsibility is to present vital material in an attractive manner. INDUSTRY & WELDING'S immediate success was the result of this editorial formula applied to a highly technical subject.

In a continuous effort to do an even better job for you, the reader, INDUSTRY & WELDING will bring you twice as much editorial material in its new size and format. The editorial staff here is the largest group of graduate engineers, all from the welding industry, on any welding magazine editorial staff. INDUSTRY & WELDING is serving you with a combination of more than 75 years experience in the welding field.

How do you like our new format? Let us hear from you.

Tom Dempsey

GENERAL MANAGER

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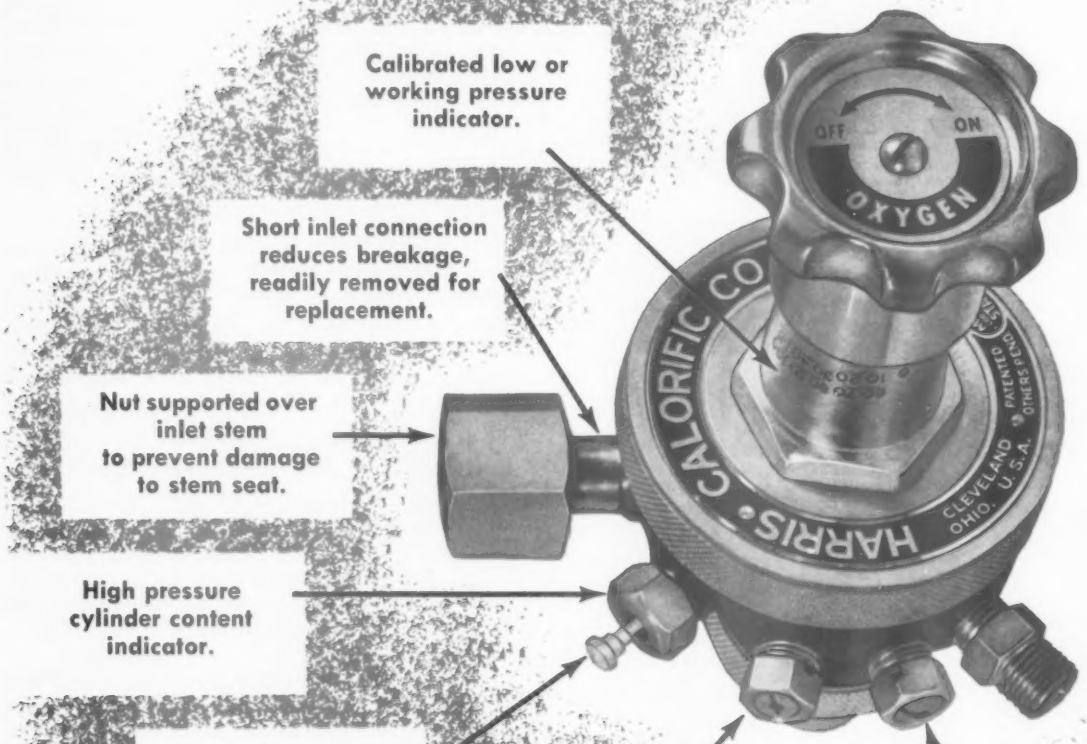
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300 . . . combination ac, dc welder design comes of age with this new Miller model. Features: new magnetic amplifier circuit; improved wave form; new arc starting control; three electrically controlled current ranges for finest adjustment; instant changeover from ac to dc; built-in high frequency. An entirely fresh concept for inert gas and metallic welding. Four basic models with kits available to convert to seven different types of welders.

300-M . . . an ac welder for inert gas and metallic arc processes. Combines unequalled welding characteristics with Miller's unique electric control circuit which permits precise slow or fast start. Features: built-in high frequency, primary contactor and ½ KVA control transformer. Offered in three basic models of from 200 to 400 amperes with optional water and gas controls available.

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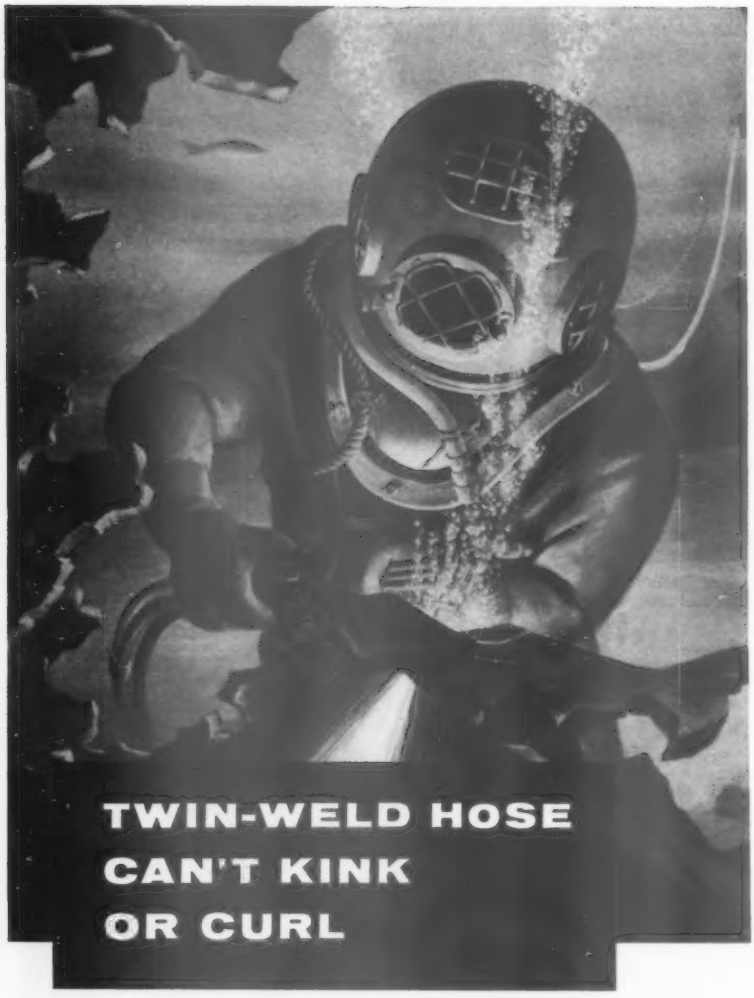

There's no wrestling with snarled hose lines when this Hewitt-Robins welding hose is on the job. It can't kink or curl because it's molded in *straight* sections by the exclusive H-R platen press process. Both oxygen and acetylene lines in a single integrated unit, yet each clearly color marked, means easier handling and moving, increased safety, longer wear, and time and money saved.

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LETTERS

to the editor

CONGRATULATIONS

Editor:

Hearty congratulations on your announcement of the new size for INDUSTRY & WELDING. This is a BIG step in the right direction.

A. V. Scherer
Air Reduction Sales Co.
New York City

HANDLING WELDMENTS

Editor:

Your July issue editorial on material handling has special appeal for me . . . my association with the field dates back more than 15 years.

You've undertaken a big job to editorialize on even the welding area alone of the broad, fast-changing material field. But in doing this, you are providing a much-needed service. It is still safe to say, that 30% of the production dollar is spent in handling materials. The continuing problem is how to keep these costs at the lowest possible level. And, the problem varies plant to plant, even department to department in a single plant.

Increased productivity—in welding as in other production operations—is not a matter of speeding up the mental and physical activity of manpower. Rather, it lies in utilizing the capabilities of manpower to the fullest extent through the availability of mechanisms and techniques that establish the level of efficiency essential for greatest production economy.

John F. Wagener,
Account Executive
Fuller & Smith & Ross Inc.
New York City

Editor:

We would appreciate your sending us a copy of your June, 1958, volume 31, issue. We are very much interested in the "Flash-welding Jet Rings Cuts Costs" article on pages 52-54.

If the magazine is not available, we would like a reprint on the article.

B. Reinhold,
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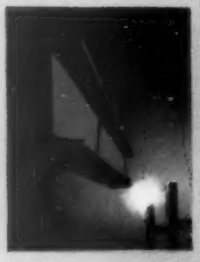
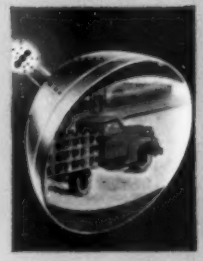
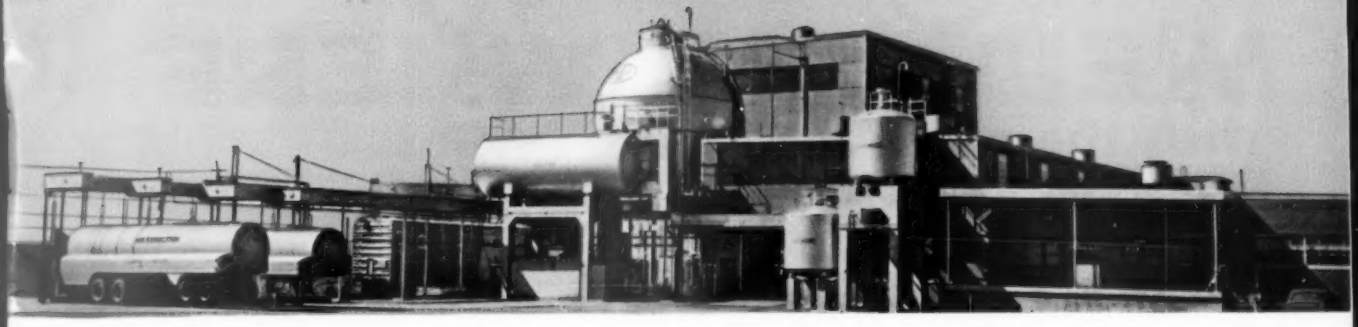




Air Reduction gases, among them oxygen, nitrogen, argon, hydrogen, helium and carbon dioxide are vital commodities in the metal-working industries.

In other industries, too, Air Reduction gases are playing an important role—food processing, electronics, steel, aircraft and missiles, and chemicals.

To all industries, Air Reduction supplies gases in whatever quantity needed, and in whatever form—gaseous or liquid. (Except hydrogen—available in gaseous form only and helium also available in liquid form currently on West Coast only, elsewhere in gaseous form.) Air Reduction industrial gas specialists, with years of practical experience and technical training, are at your service to help you make the most efficient use of industrial gases. Ask the Airco representative in your vicinity to show you why your gas requirements are best served by Air Reduction.



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AT THE FRONTIERS OF PROGRESS YOU'LL FIND AN AIR REDUCTION PRODUCT • Products of the divisions of Air Reduction Company, Incorporated, include: **AIRCO** – Industrial gases, welding and cutting equipment • **AIRCO CHEMICAL** – vinyl acetate monomer, vinyl stearate, methyl butynol, methyl pentynol, and other acetylenic chemicals • **PURECO**–carbon dioxide–gaseous, welding grade CO_2, liquid, solid ("DRY-ICE") • **OHIO**–medical gases and hospital equipment • **NATIONAL CARBIDE**–pipeline acetylene and calcium carbide • **COLTON**–polyvinyl acetate, alcohols, and other synthetic resins.

WELD ANYWHERE

with the new Aircomatic® MIGet

(pronounced "midget")

The lightweight, versatile Aircomatic MIGet, for gas-shielded arc welding, operates 50 ft. from control panel, with control panel 100 yds. from power supply!

The MIGet carries its own drive rolls and one-pound reel of .030", .035", 3/64" or 1/16" aluminum wire; or two-pound reel of .030", .035" or .045" hard wire. Feed speed to 900 inches per minute . . . 200 amperes. DC. Air cooled. Gun, without reel, weighs about three pounds. Control cabinet, 17 pounds. Here is *THE* gun for short-length welds in hard-to-get-at places.

Send today for technical literature on the Aircomatic MIGet. Or phone your nearby Air Reduction Sales Office.

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It's Up to 50% Cooler Inside...

Protection For Welders

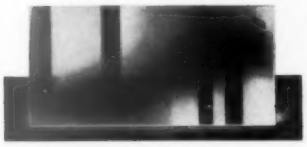
"Yessir this white AO Helmet is *real* cool!"

A White AO WELD-COOL Welding Helmet!

(Reflects 70% of Radiant Heat)

This is the helmet *welders* have told us they wanted for years! And why not, when test after test shows that this helmet is 50% cooler inside.

Keeps the welder more comfortable — makes him more efficient. Another feature — the easy "radio dial" turning of adjustment knob to proper head size . . . and the AO 168AL aluminized plastic coverplate which provides additional coolness in the eye area. Inside of helmet is black to eliminate any possibility of diffusing harmful light rays and to permit easy cleaning. Helmet is particularly recommended for gas shielded arc welding. Also adaptable to outdoor welding because of the moisture resistance of its fiber glass construction.



No. 168AL CLEAR PLASTIC ALUMINIZED COVER PLATE

Highly reflective helmet cover plate. Reflects radiant heat — keeps welders cooler, more comfortable, more productive.

QUICK FACTS

- Fiber glass — nonwarping and moisture-proof, lightweight, strong.
- Flame resistant.
- Reflective, cool, aluminum glass holder — stationary or lift front.
- *New plastic* self-locking rear adjustment head-gear — Locks securely once set to proper head size.
- Excellent ventilation.
- Adjustable vulcanized fiber chin rest for easy alignment of helmet in line of vision.
- FOR WHITE EXTERIOR SHELL ASK FOR AO 9702-W or AO 9706-W. For dark gray shell ask for No. 9702 or No. 9706. (No. 9706-W illustrated.)

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1833-1958 • 125 LEADERSHIP YEARS

Always Insist on AO Trademarked Safety Products

Your nearest American Optical Safety Products Representative can supply you.

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← Circle No. 4 and write in product name.

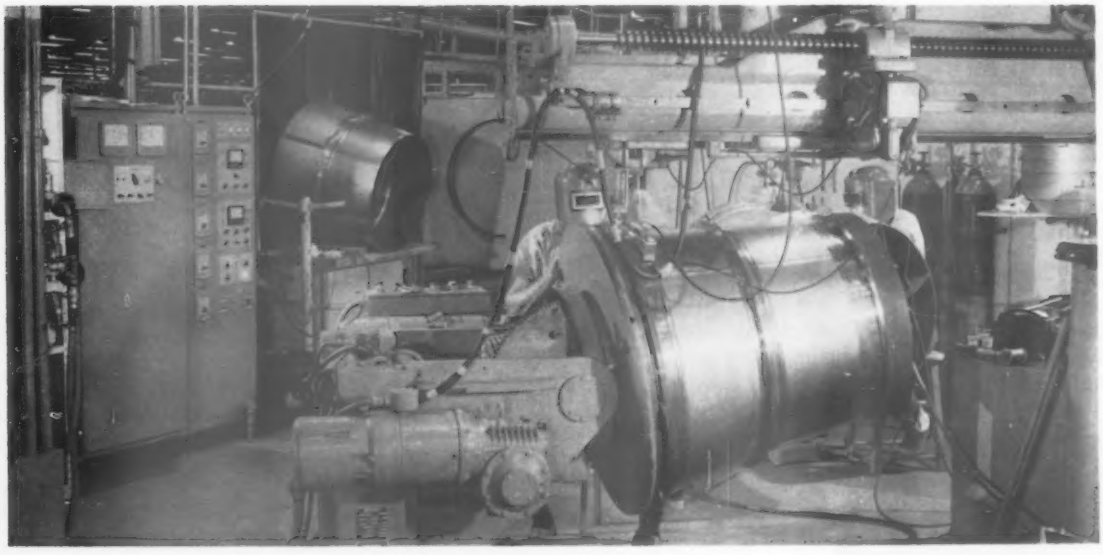
WELDING AT WORK

to do the job better and cheaper

WELDING: Tungsten arc process joins three 30-foot tubing sections.

American racing yachts sail under strong,

NEWPORT, R.I.: Three spanking new 12-meter sloops and a 19-year old veteran are locked in a winner-take-all racing series for the right to defend the America's Cup against the British challenger, the *Sceptre*. Crews of the *Easterner*, *Columbia*, *Weatherly*, and old-timer *VIM*, are matching racing skill and marine know-how. But, all have one advantage in common: towering aluminum mast fabricated from Aluminum Company of America tubing.



Electronic equipment makes uniform welds in titanium

DALLAS, TEXAS: Used in a J-57 jet engine project at Tempco Aircraft Corp., this electronically controlled equipment gives a high degree of uniformity in titanium welds. Built by Sciaky Bros., Inc., the automatic equipment uses an inert gas to shield front compressor cases.

Seam welds on the cases vary in thickness: the retainer rings are all .050-inch thick; the skin segments range from .063, .080 to .095-inches.

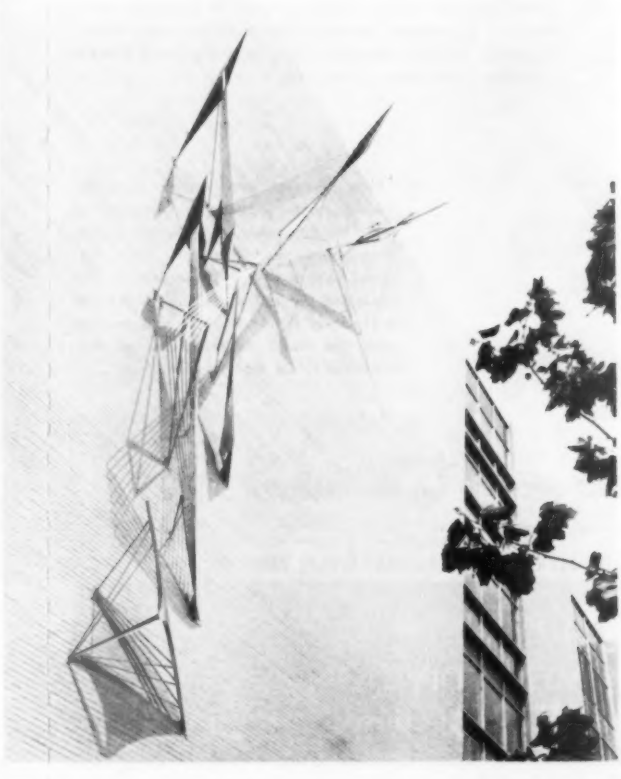
FORMING: Top mast section gets slim, graceful taper.

OFF TO THE RACES: Mast is shipped to yacht yard.

graceful all-welded aluminum masts

According to international rules, masts for the Twelves must weigh at least 1,000 pounds. They cannot extend more than 82-feet above deck. Use of aluminum makes possible a mast strong enough to handle the more than 1900 square feet of sail required, without sacrificing height to avoid excess weight.

Alcoa supplied three 30-foot sections of extruded tubing for each mast. The elliptical tubing had a wall thickness of .230-inches. The larger diameter was 11.925-inches, and the minor diameter measured 9.652-inches. Mast assembly was completed by butt welding the three sections, using the inert gas method.



Modern sculptors use welded stainless steel

LONG ISLAND CITY, N.Y.: Strong, enduring and beautiful stainless steel was the material chosen by Gwen Lux for her symbolic representation, "Vapor Trails," which now adorns a wall of new Aviation High School.

The sculpture is a non-objective representation of jet planes of the future as they climb to the threshold of outer space. A number of stainless steel tubes and sheets symbolize crisscrossing vapor trails as the planes appear to surge upward.

Miss Lux chose stainless for both practical and symbolic reasons. Stainless is almost completely impervious to the corrosions of the industrial atmosphere of Long Island City. And, stainless is one of the chief metals of modern jets and doubtless will be of future jets.

The sculpture is 56-feet high (5½ stories) and weighs 800 pounds. It was made from Type 304 stainless supplied by Electro Metallurgical Co. and was fabricated by Linde Company's inert gas shielded tungsten arc process. Both companies are divisions of Union Carbide Corp.

WEBB TANK PRODUCTION MACHINERY

REED OFFSETTER

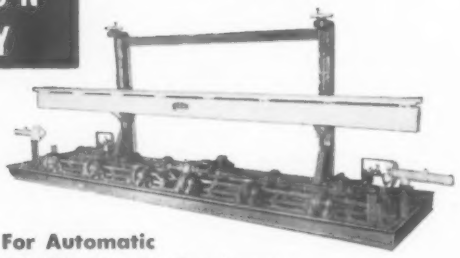
This machine forms an offset flange around shell ends to facilitate automatic welding of tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result. Three sizes of Offsetters handle up to ½" plate with standard dies. Illustrated with Turntable for reversing shell ends when both ends are to have offset flanges formed.

REED ASSEMBLY PRESS

Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically; tailstock is also adjustable along the bed for various lengths of vessels up to 18'.

Fit-up rolls are also available to facilitate proper alignment and assembly of shells lacking rigidity.

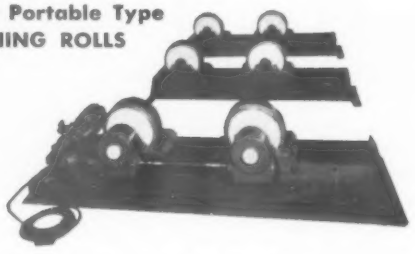
REED TRACK SUPPORTS



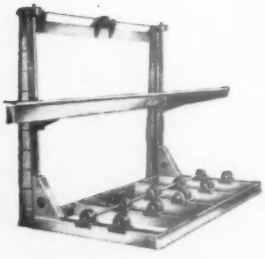
For Automatic Welding Head Carriages

Increase production—use this fixture on 4' to 12' diameter work. Welding track is 24' to 34' long. Powered vertical adjustment is available for all models. May be used with your present turning rolls, welding positioners, special jigs for straight seam work, or portable type rolls illustrated below.

REED Portable Type TURNING ROLLS



For manual or automatic welding and other operations requiring rotation of a cylindrical vessel. Capacities range from 3 tons to 75 tons; larger units built to special order. Powered by electric motor with variable speed transmissions. Readily portable, they may be used free or anchored to the floor as desired.



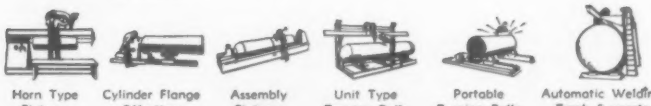
UNIT TYPE ROLL

A complete line of Unit Type Track Supports and Turning Roll Fixtures can be provided for the welding of longitudinal and girth seams of cylindrical vessels, to 12' in diameter and weighing up to 9 tons.

The unit is of all steel construction and all critical surfaces are machined to insure accuracy.

SEAM WELDER

←These fixtures are widely used for single pass automatic longitudinal seam welding, using closed butt joints. This is designed primarily for cylindrical shapes and will also handle flat work and conical shapes. The material is clamped firmly in the jig in contact with the water cooled back up bar. Machine is all steel construction.



Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures | Unit Type Turning Rolls | Portable Turning Rolls | Automatic Welding Track Supports

FOR ILLUSTRATED LITERATURE WRITE DEPT. C

REED EQUIPMENT DIVISION
THE WEBB CORP. WEBB CITY, MO. U. S. A.

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WELDING CLINIC

J. Imperati and R. F. Pulver, Welding Engineers
The American Brass Company, Waterbury, Conn.

Steel products are quickly and economically assembled by Braze Welding

Side of a hospital bed being assembled at Simmons Co., Kenosha, Wisc., by braze welding with Anaconda-997 (Low Fuming) Bronze Welding Rod.

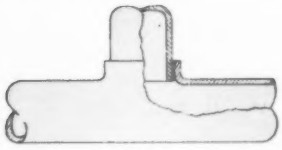
Oxyacetylene braze welding is widely used for economical assembly of many steel articles which do not lend themselves to joining by arc welding or resistance spot welding. Many are made from steel tubing and include school and office furniture; frames for motor scooters, bicycles, and wheeled toys; handles for portable saws, generator sets, and other equipment, etc. Others, made from sheet and strip, rods, castings and forgings, are storm sash and screen frames, auto-body and mechanical parts, wrought-iron furniture and decorative items, office furniture, cabinets and enclosures for sinks, refrigerators, ovens, etc.

The advantages of braze welding are low temperature of application, excellent control of weld metal, low-cost joint preparation, and simple holding-fixture or jig design needed for efficient production. These advantages are fully realized by use of Anaconda-997 (Low Fuming) Bronze, Tobin Bronze®-481, and Nickel Silver-828. Since the low temperatures employed do not melt the steel, the weld metal is easily controlled to form smooth joints and fillets, and, in contrast to fusion welding, there is no need for skilled manipulation of flame and welding rod. The low temperatures needed and the excellent ductility of the weld metal also eliminate most of the tendency to cause distortion.

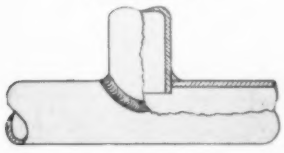
Steel file cabinet panel has corners braze welded with Anaconda-997 rod.

Simple fixture design. In most cases the joints are of such size that they can be made in a single step by heating from one side only. This simplifies fixture design and reduces handling operations.

Low-cost joint preparation. The molten braze-welding alloys easily bridge the gaps resulting from poor fit-up, and readily build up smooth fillets to develop maximum joint strengths. Cost of joint preparation is the lowest possible since there is no need for the accurately fitted laps required in the usual brazed lap joint.



Brazed lap joint



Bronze-welded joint

Vapor fluxing. A widely used adjunct to braze-welding operations is a vapor-fluxing device, installed in the fuel-gas line, to supply a uniform, small amount of flux through the flame. In this way, the joint surfaces are protected from oxidation just as soon as heating is started, and the braze-welding operation is expedited through complete fluxing, increased weld fluidity, less tendency to fume, and elimination of separate fluxing operations.

For more information. Anaconda distributors will gladly help in the selection of the exact rod for your job. Or write for a copy of new Publication B-13. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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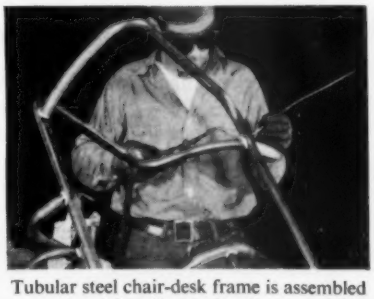

Tubular steel chair-desk frame is assembled on a revolving fixture by braze welding with Anaconda-997 rod—23 braze welds per unit, in 17 minutes.

ANACONDA®
WELDING RODS
made by
The American Brass Company

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Introducing the NEW MODEL 1-A SEVER-ALL Machine... CUTS AT 3 to 6 SECONDS PER SQUARE INCH—ECONOMICALLY

MANY EXTRA FEATURES AT A DELIVERED COST UNDER $500

You get the cut quality and capacity of machines nearly three times as expensive when you use the new Model 1-A SEVER-ALL oscillating dry abrasive cut-off machine. Available from your distributor's stock. Here's why the #1-A SEVER-ALL is ideal for industrial and machine shop operations:

BIG CAPACITY • Up to 2″ square solids, 3½″ O. D. pipe and tubing, 3″ angle iron, and 4″ channels . . . of cold rolled, stainless, and alloyed steel; cast iron; and nonferrous metals. Wheel oscillation, an exclusive feature in this price range, provides this *above-average* capacity.

SPEED • Cuts a 2″ x 2″ hardened steel bar in 16 seconds . . . other shapes and sizes at 3 to 6 seconds per square inch.

QUALITY • Clean, smooth cuts, even on large sections, because wheel oscillation provides cooler cutting.

ECONOMY • In addition to low initial cost, the Model 1-A SEVER-ALL is inexpensive to operate . . . occupies minimum floor space . . . requires little or no set-up time . . . eliminates annealing costs . . . gives more cuts per wheel because of oscillation.

SIMPLICITY • Just two SEVER-ALL cutting wheel specifications will do *all* your SEVER-ALL cutting jobs. A positive, screw-type vise holds all regular shapes, and an adjustable work stop provides speed and accuracy.

ANGLE CUTS • Optional accessory permits cutting angles up to 45° in either direction.

NEW SEVER-ALL AVAILABLE FROM DISTRIBUTORS

Very likely your own distributor already stocks the Model 1-A SEVER-ALL machine and wheels. If not, let us know, and we'll give you the name of your nearest SEVER-ALL distributor. Also, we'll be glad to send you complete details on this new machine. Just ask for **Bulletin DH-106.**

ALLISON-CAMPBELL DIVISION
AMERICAN CHAIN & CABLE

ACCO

925-S. Connecticut Avenue, Bridgeport 2, Conn.

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NEW! KING BRAND

WELDING WIRE FOR HIGH STRENGTH WELDING

Now an entirely new type of *bright* welding wire for MIG and TIG welding processes is available for high strength welding . . . Kaiser Aluminum's King* brand welding wire.

It's available in a complete line of welding rods and electrodes in a broad range of alloys — including new all-purpose alloy 5183, developed specifically for welding the high strength magnesium-bearing aluminum alloys 5083 and 5086.

The consistent high quality of King brand bright finish welding electrodes and rods is achieved by rigid production and inspection controls, including radiographic and destructive testing of actual welds.

Available at leading welding supply distributors across the country. Call your local Kaiser Aluminum sales office, listed in your phone book, for additional information.

Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Avenue, Chicago 11, Illinois.

*Kaiser *I*Nert *G*as

Available In A Broad Range Of Alloys		
One and ten pound spools and straight lengths. Diameters ranging from .030 to ¼ inches.	1100	5154
	4043	5183
	5052	5254
	5356	

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

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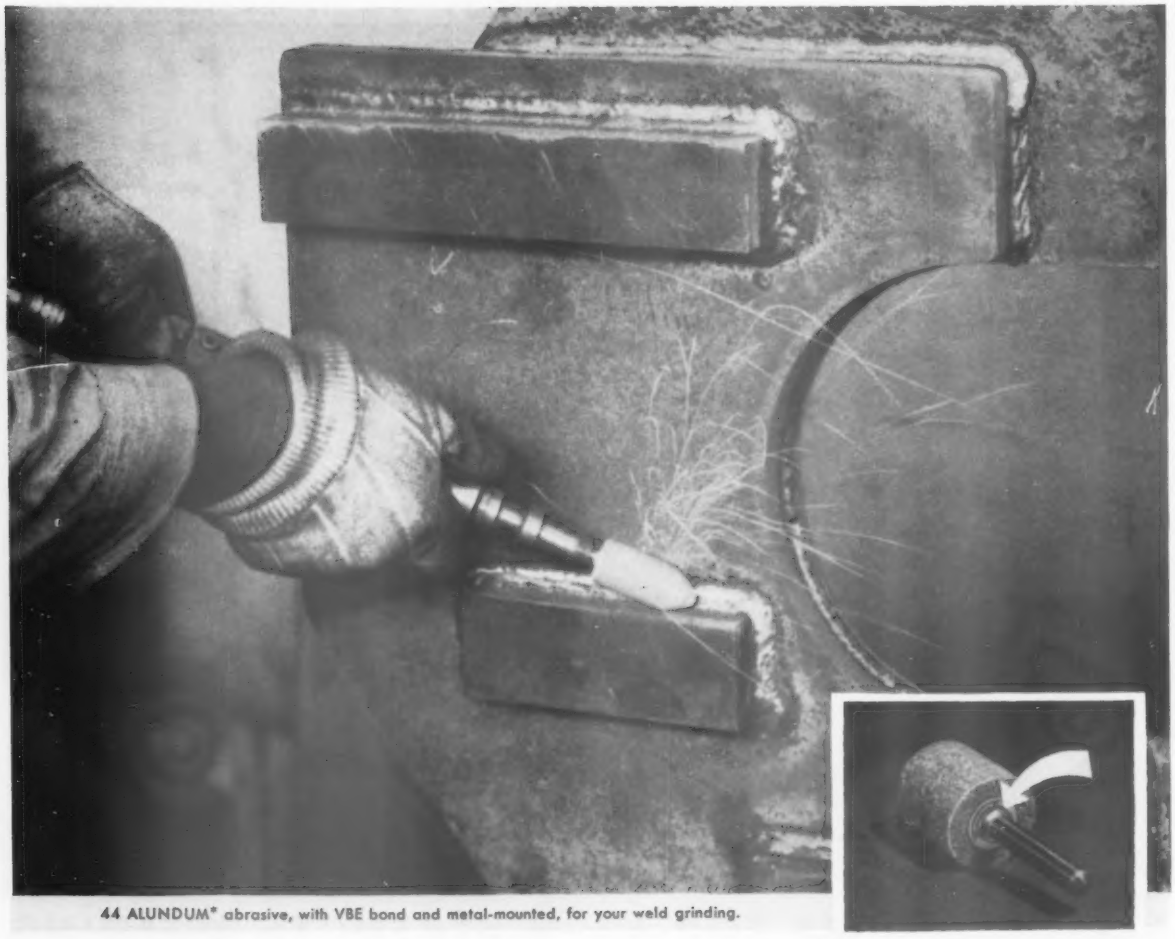

44 ALUNDUM* abrasive, with VBE bond and metal-mounted, for your weld grinding.

Here's how Norton keeps

"Making better products to make your products better"

In weld grinding, as throughout their entire job range, Norton mounted wheels are hitting new highs in grinding efficiency.

Outstanding new developments in abrasives and wheel construction eliminate loading and glazing — besides giving you the fastest cutting rate, with a marked increase of stock removed per wheel.

These advantages are the natural results of Norton Company's long experience in engineering mounted wheels for best performance in every application — from tool and die finishing to all kinds of rough grinding.

For weldments and steel castings, mounted wheels of 44 ALUNDUM abrasive, with VBE bond and metal-mounted, are unequalled. "44" grinds better than other non-premium priced abrasives because it's made differently, for extreme toughness. And the VBE vitrified bond assures the ideal structure for mounted wheel weld grinding.

METAL-MOUNTING — Another Norton Exclusive — You throw nothing away but the mandrel!

Norton does it again! . . . The mounted wheels are so securely anchored to the mandrel — *you use all of the abrasive!* No waste . . . all work! This radically improved method of locking the abrasive body to the mandrel is used on mounted wheels in most sizes and shapes, 5/16" diameter and larger. Molten metal, injected into the abrasive recess at high pressure, does it — and does it fine!

Every Norton mounted wheel is accurately trued *after mounting* on rust-proof stainless steel mandrels. Developed to increase the time-and-money-saving "Touch of Gold", Norton mounted wheels are stocked in approximately 200 standard shapes and sizes. See your Norton Distributor for prompt deliveries.

Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

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NORTON ABRASIVES

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEAR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

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How semi-automatic hard surfacing saves time and material at Bradford Hills Quarry

"Changing to the semi-automatic application of nickel manganese surfacing material almost saved us the price of the Wear-O-Matic machine in just five weeks," says Thomas Risbon, Welding Foreman for Bradford Hills Quarry, East Petersburg, and Downingtown, Pa.

The Wear-O-Matic unit at Bradford Hills Quarry is used almost exclusively for maintaining their new 57-60 Universal Impactor. Over a five week period, nightly maintenance on this crusher required 500 pounds of 7/64" Wear-O-Matic nickel manganese wire to provide normal operating tolerances.

During a similar period, 800 pounds of ¼" nickel manganese stick electrodes were required to provide the same amount of wear protection to the impactors.

Savings in maintenance operations in your industry are important because they affect profits. Find out how the Wear-O-Matic process can help lighten your maintenance load. It's built right and priced right* to provide for you the most efficient maintenance on all equipment subject to wear. Request Bulletin HS-101 Alloy Rods Company, P. O. Box 1828, York, Pennsylvania.

From this platform on the crusher, the Wear-O-Matic unit is used nightly to maintain proper impactor size for most efficient operation.

Weldor Gene Johnson says, "It's easy to turn out square edged impactors like this with the Wear-O-Matic process and, it's less tiring than stick electrodes."

* Price f.o.b. York, Penna. $279.00.

QUALITY WELDING ELECTRODES FOR

Stainless Steel
Mild & Low Alloy Steels
Cast Iron
Tool Steel
Bronzes & Dissimilar Metals
Hard Surfacing Electrodes & Wires

Alloy Rods Company

YORK, PENNSYLVANIA • EL SEGUNDO, CALIFORNIA

Alloy Rods Co.

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NOW, A MANGANESE STEEL ELECTRODE
with High Build-up, Low-spatter, Easy Slag Removal

A special new Amsco rod, Nicro-Mang, for both joining and buildup of manganese steel

Out of Amsco® metallurgical research has come a new welding rod that gives you high weld strength without cracking on Austenitic manganese steel. A rod that lets you lay down a bead without slag popping, and slag removal is easy.

To lick the cracking problem, it took a special alloy of chromium and nickel, plus a unique coating for Nicro-Mang.

Write for Nicro-Mang bulletin, or see your local Amsco distributor.

Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

AMERICAN Brake Shoe COMPANY

AMSCO

American Manganese Steel Division • Chicago Heights, Illinois

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LIBRARY

of welding

WELDING HANDBOOK: SECTION II

Section II, Welding Handbook, New York, N.Y.: American Welding Society, 33 West 39th St., $9.00.

The availability of Section II of the Fourth Edition of the Welding Handbook has been announced by the American Welding Society. Containing 13 chapters, this section covers gas, arc and resistance welding processes. Each chapter has a comprehensive bibliography and its own table of contents. Processes of a similar nature are grouped and followed by a chapter describing various types of equipment and accessories available.

The AWS Welding Handbook has been divided into five sections: one section will be published each year (Section I published in September, 1957, dealt with fundamentals of welding). When the five-volume edition has been completed, Section I will be revised again.

REVISED BUTT-WELDING STANDARDS

American Standard B16.9-1958 and American Standard B16.25-1958, New York, N.Y.: American Standards Association, 70 East 45th St. and American Society of Mechanical Engineers, 29 West 39th St. $1.50 and $1.00, respectively.

These two revisions have been approved by the American Standards Association and published by the American Society of Mechanical Engineers.

Both are sponsored by the Mechanical Contractors Association of America, the Manufacturers Standardization Society of the Valve and Fittings Industry and the A.S.M.E.

B16.9-1958 covers over-all dimensions, tolerances and markings for wrought and cast carbon- and alloy-steel welding fittings, known as American Standard Steel Butt-Welding Fittings. The term "wrought" is used to denote fittings made of pipe, tubing, plate or forgings.

The present revision includes fittings for use with 22-inch pipe and additional dimensions for 14-inch and larger tees and reducing tees, as well as other changes to keep the standard up to date with current requirements.

American Standard B16.25-1958 covers the preparation of butt-welding ends of pipe, valves, welding neck flanges and pipe fittings. It is also applicable to other piping components which are connected into the piping system by butt-welding. The standard includes requirements for re-entrant shapes for heavy wall ends, welding bevel profiles inside contours for joints made with or without backing rings and machining dimensions with their tolerances.

"Baltospot is lightweight—the only completely portable 140-kv unit on the market. Ideal for inaccessible places."

E. E. Ellis says, "There's nothing to it. This unit will radiograph steel up to 1¾ inches thick."

"In less than a day I could teach anyone to make good inspection X-rays with BALTOSPOT,"

E. E. Ellis

J. B. Fisher

says E. E. Ellis, Welding Engineer and Radiographer, Fisher Tank Company, Chester, Pennsylvania. "One year of experience with Baltospot X-ray equipment proved to us that practically anyone can make good radiographs. There are just three simple steps:

1. measure thickness of part and refer to chart
2. make exposure
3. develop film according to chart

X-ray inspection keeps us on our toes and is far ahead of other methods."

Does Baltospot Pay?

"It certainly does," says J. B. Fisher, President, Fisher Tank Company. "We exercise better control over all phases of work, and save approximately 77 percent in radiography costs. Helping our welders maintain uniform high quality and developing new welding techniques are prime functions of this, the most effective means of testing welds."

Your Westinghouse X-ray Specialist has information on the full line of industrial radiographic-fluoroscopic equipment, or write: Westinghouse X-ray Department, 2519 Wilkens Avenue, Baltimore 3, Maryland. J-08369

YOU CAN BE SURE...IF IT'S

Westinghouse

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INVINCIBLE
WELDING FLUX RECOVERY SYSTEMS

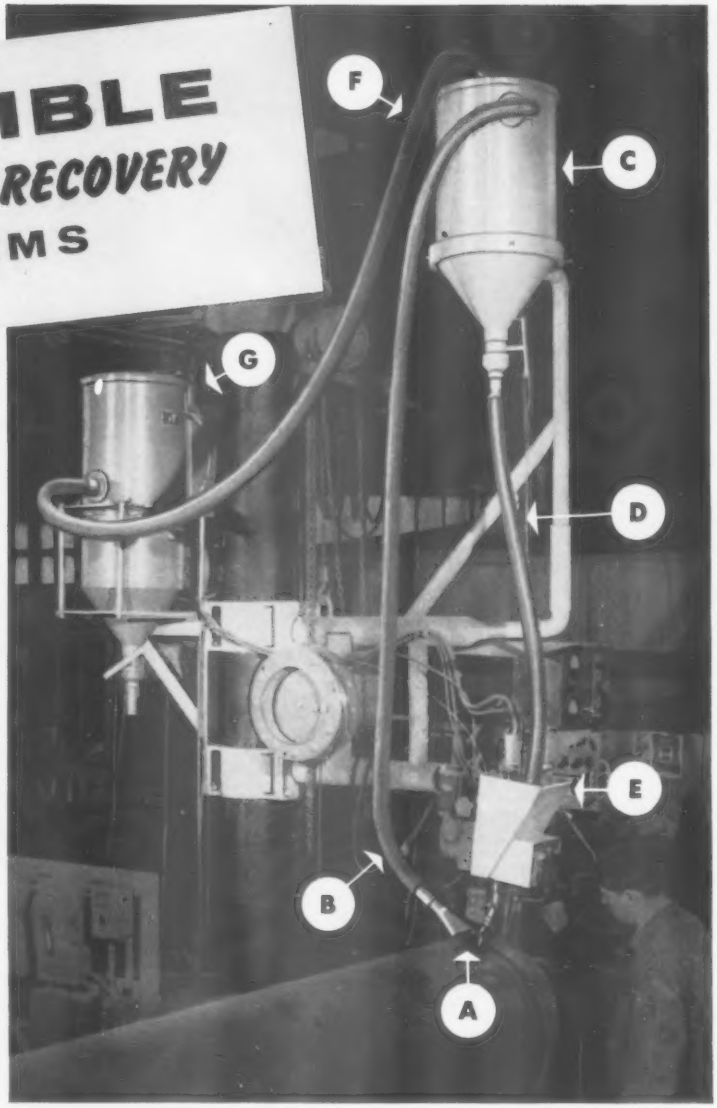

Photo courtesy of Northern Power and Industrial Piping, Ltd., Toronto

Reclaim Flux Automatically . . . Give Big Return on Investment

By using Invincible Systems on submerged arc welding jobs, one manufacturer salvages 100 pounds of flux daily; another reclaims $400 worth each day. Value of the material alone paid for the units within a few weeks.

Invincible units, like that in the photo, recover all unfused flux, remove powder and return slag-free, dust-free flux to the welder in a *continuous flow.*

Recovering flux is only part of the story. Invincibles also save costly manhours over manual methods, speed production and minimize expensive rejects by eliminating flux flour.

Invincibles are available in a wide variety of automatic and manual models. Compact, and highly flexible, they can be fitted to your specific operations, eliminating the need for costly tailor-made installations. Engineered to resist the abrasive nature of flux, Invincibles are ruggedly built for heavy-duty service.

Automatic operation of this Invincible makes possible complete recovery of unfused flux from circumferential butt weld operation. Here is how it works:

A. Nozzle draws flux up from work.

B. Recovery Hose.

C. Primary Separator separates usable flux from slag and fine dust.

D. Return Hose.

E. Flux returned into Hopper of welding head.

F. Hose connects Primary Separator (c) to Vacuum Producer (g).

G. Invincible Vacuum Producer provides vacuum for entire system and draws off the fines.

WRITE TODAY FOR FOLDER
giving full information on all types of Invincible Flux Recovery Systems.

INVINCIBLE

VACUUM CLEANER MFG. CO.
DOVER, OHIO

OVER 50 YEARS THE LEADER IN INDUSTRIAL VACUUM EQUIPMENT

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for hard surfacing...

McKAY

AUTOMATIC & SEMI-AUTOMATIC

tube-alloy® wires

- smooth operation
- high deposition
- uniform, wear-resistant deposits
- controlled chemistry
- wide range of analyses

Years of research, development and experience in welding electrode manufacturing are combined to make McKay "Tube-Alloy" the most efficient and economical wires for automatic and semi-automatic hard surfacing applications. Tube-Alloy wires lay down sound, clean weld deposits of controlled composition and hardness. The closely compacted tubular wires feed smoothly and evenly. Deposition rates are double or more over manual operation . . . thus greatly reducing overall hard surfacing costs.

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HARD SURFACING CATALOG

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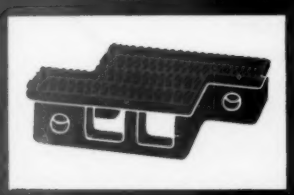
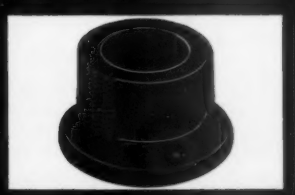
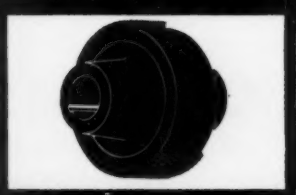


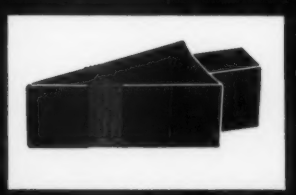
Tractor Rails
TUBE-ALLOY BU WIRE



Ditcher Rollers
TUBE-ALLOY 252



Shovel Rollers
TUBE-ALLOY 258



Shovel Bucket Teeth
TUBE-ALLOY 218

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Power Supply Cable

...it's worth engineered cable

One Wire Source for Everything Electrical and Electronic

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Welding Cable • Electrical Household Cords • Electronic Wires • Automotive Wire and Cable

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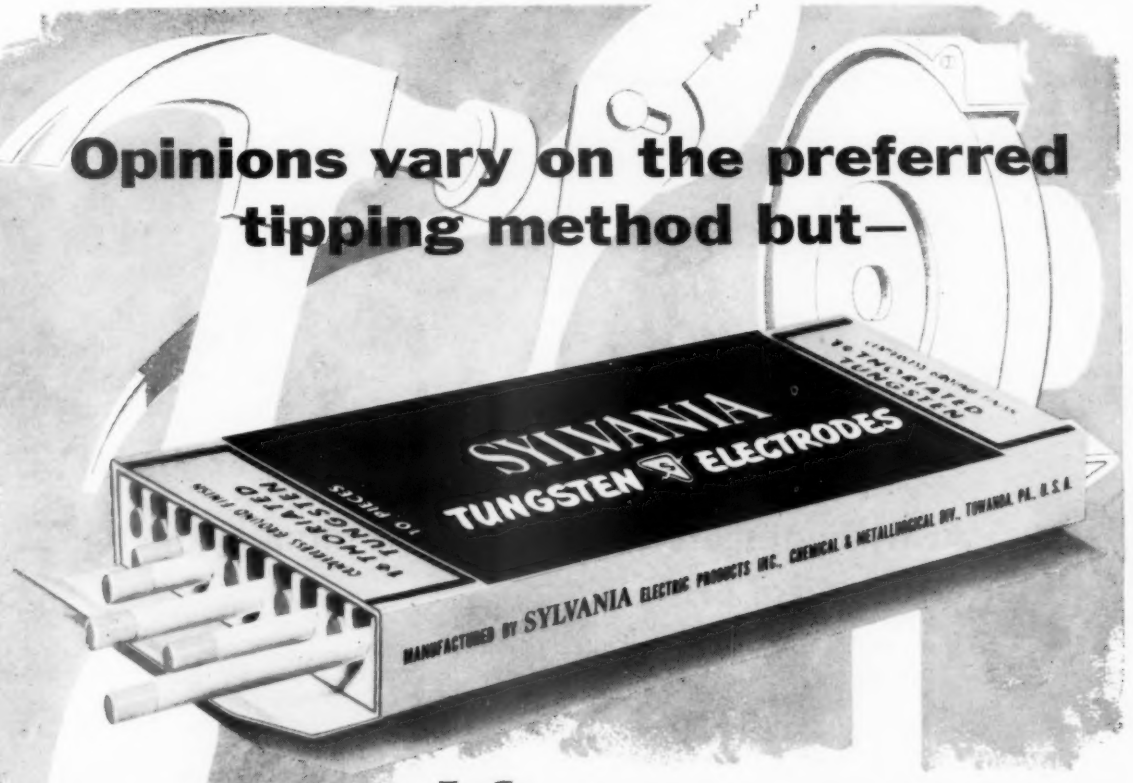
Opinions vary on the preferred tipping method but—


SYLVANIA
TUNGSTEN ELECTRODES
MANUFACTURED BY SYLVANIA ELECTRIC PRODUCTS INC. CHEMICAL & METALLURGICAL DIV. TOWANDA PA. U.S.A.

most welders agree on the preferred electrode

Welders say they prefer Sylvania Tungsten Electrodes because they tip easily and economically. Now Sylvania packs money-saving information on tipping with every package of welding electrodes. The leaflet "How to Avoid Waste" presents methods for proper re-tipping which are the results of experience and research.

It's just one more reason why, more than ever, welders prefer Sylvania electrodes and why your welding supply distributor is happy to serve you with the industry's only complete line.

Remember too, that for further protection against waste, Sylvania electrodes are color-coded and packed in a protective wood filler.

Ask your distributor for Sylvania next time you order.

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ALL-WELDED ALUMINUM TRUSS PANELS like this one are the backbone of this 90-foot military bridge.

Army engineers test all-welded aluminum trusses for military tactical bridges

What the army wants to know: how well will a 90-foot span of welded aluminum trusses hold up under the weight of a 60-ton tank?

FORT BELVOIR, VA: U.S. Army Engineer Research and Development Laboratories are conducting structural tests on four, full-size experimental all-welded aluminum truss panels for a military tactical bridge.

Believed to be the first of their kind in this country, the truss panels were fabricated by Aluminum Company of America from one of the new non-heat-treatable, weldable aluminum alloys. Design of these experimental truss panels has been based upon the general data currently available.

It is anticipated that the truss components will support a 60-ton tank load on approximately a 90-foot span. In order to obtain this capacity in the past—when high strength, heat-treatable aluminum alloys were used—it was necessary to build up basic panel members by neutral axis welding. The panel components were then joined by riveting or bolting.

Since military bridge equipment has to be portable and rapidly constructed, the bridge trusses are divided into light-weight, simply connected panels. The basic features of the experimental panels are length: 16-feet, 2-inches; height: 7-feet, 7-inches; fabricated weight: 920 pounds. All of the members of the truss panels were fabricated from aluminum alloy 5456-H321 plate stock which has an ultimate tensile strength of 42,000 psi. The upper and lower chords are box sections. All of the welding was done by the consumable electrode process.

The results of the structural tests are expected to give some indication of the feasibility of welded aluminum truss panels for heavy military vehicular loads. They should furnish test data that can be used in the development of more specific design criteria for similar truss-type structures.

NEWS BRIEFS

BELDEN MANUFACTURING COMPANY, Chicago, Illinois, announces the revision of their "Welding Cable Visarama" which is a professionally prepared visual sales meeting designed to improve the product knowledge of the company's distributors' salesmen and counter salesmen. The revised Visarama features Belden's new Neoprene cables and whip leads, as well as recent improvements in cable packaging.

A $1,200,000 ADDITION to the metals research building at Armour Research Foundation of Illinois Institute of Technology will be dedicated on Monday, October 20. The four-story addition, on the north end of the building at 3350 S. Federal St., Chicago, will more than double the amount of previously available space for metals projects, giving the department a total of 68,000 square feet of working space.

MONTANA GAS FIRM HAS NEW NAME: The company which has been doing business in Billings, Montana, as "Home Oxygen Company" is now operating under the name "National Cylinder Gas Division of Chemetron Corporation," it was announced by J. L. Adank, division president. Home Oxygen became a subsidiary of National Cylinder Gas in 1955.

A NEW, MODERN WAREHOUSE-SERVICE center to serve Columbus, Ohio, area industry has been established by Eutectic Welding Alloys—Ohio Valley Division, Inc. Located at 206 West Mound Street, the installation will be managed by V. J. Ridgway.

TO BECOME BETTER ACQUAINTED with welding, some 30 building officials and inspectors of Metropolitan Toronto, Ontario, Canada, recently took an 8-session course at the Ryerson Institute of Technology. Sponsored by the Canadian Welding Bureau, the course gave those enrolled actual welding experience so they might better locate and assess welding defects.

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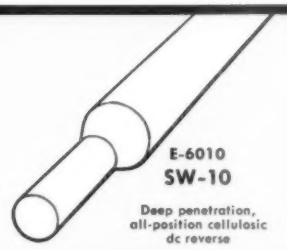
A. O. SMITH OFFERS

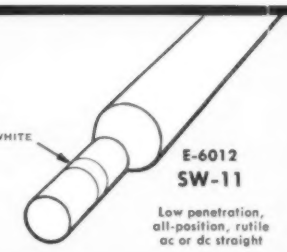
Cho

MILD STEEL



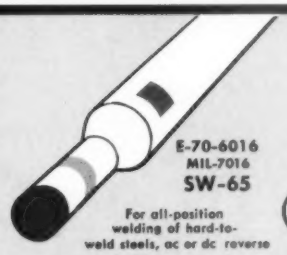
E-6010
SW-10
Deep penetration, all-position cellulosic dc reverse

E-6011
SW-14
Deep penetration, all-position cellulosic ac-dc reverse

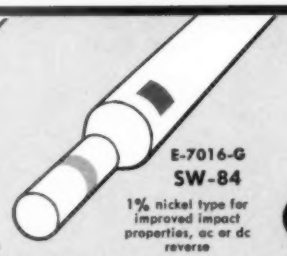


E-6012
SW-11
Low penetration, all-position, rutile ac or dc straight

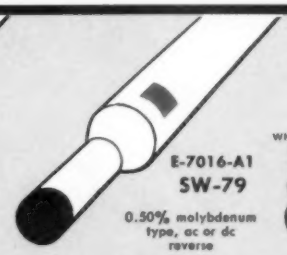
LOW HYDROGEN



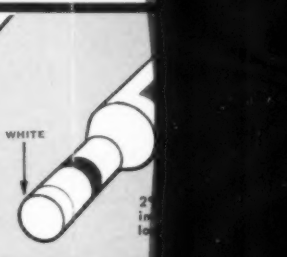
E-70-6016
MIL-7016
SW-65
For all-position welding of hard-to-weld steels, ac or dc reverse

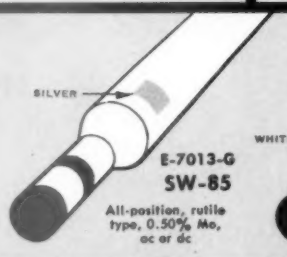


E-7016-G
SW-84
1% nickel type for improved impact properties, ac or dc reverse

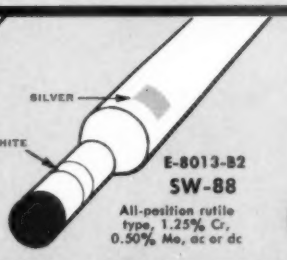


E-7016-A1
SW-79
0.50% molybdenum type, ac or dc reverse





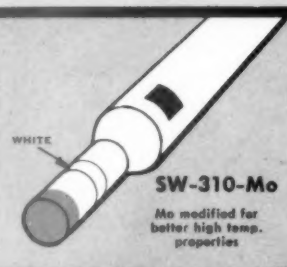
E-7013-G
SW-85
All-position, rutile type, 0.50% Mo, ac or dc



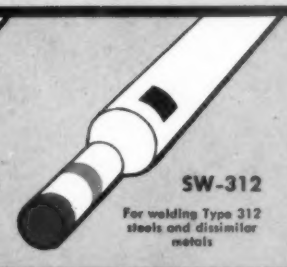
E-8013-B2
SW-88
All-position rutile type, 1.25% Cr, 0.50% Mo, ac or dc

E-9010-G
SW-95
Deep penetrating, all-position, cellulosic for maintenance, dc reverse

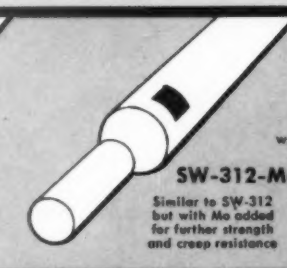
E-12020-G
SW-101
Spray-type, iron oxide Ni-Cr-Mo-V, for high-tensile steels, ac or dc straight



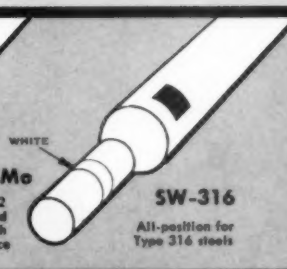
SW-310-Mo
Mo modified for better high temp. properties



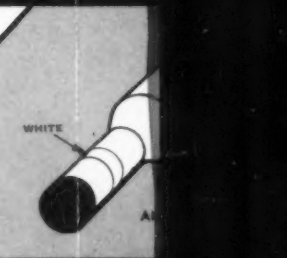
SW-312
For welding Type 312 steels and dissimilar metals

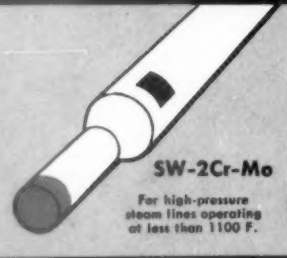


SW-312-Mo
Similar to SW-312 but with Mo added for further strength and creep resistance



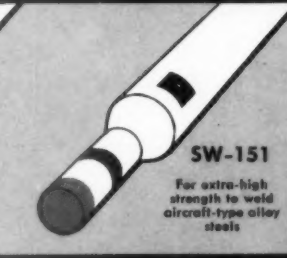
SW-316
All-position for Type 316 steels



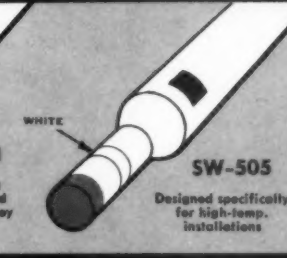


SW-2Cr-Mo
For high-pressure steam lines operating at less than 1100 F.

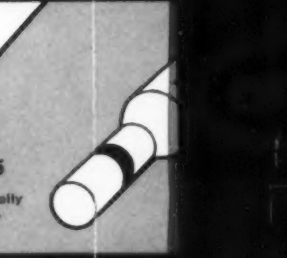
SW-502
For high-temp. installations . . . 4-6% Cr steels



SW-151
For extra-high strength to weld aircraft-type alloy steels



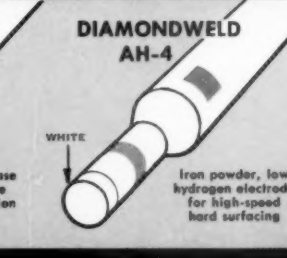
SW-505
Designed specifically for high-temp. installations



DIAMONDWELD AH-1
Iron powder electrode as base for hard surface overlays

DIAMONDWELD AH-2
Moderate abrasion, heavy impact and base for overlays

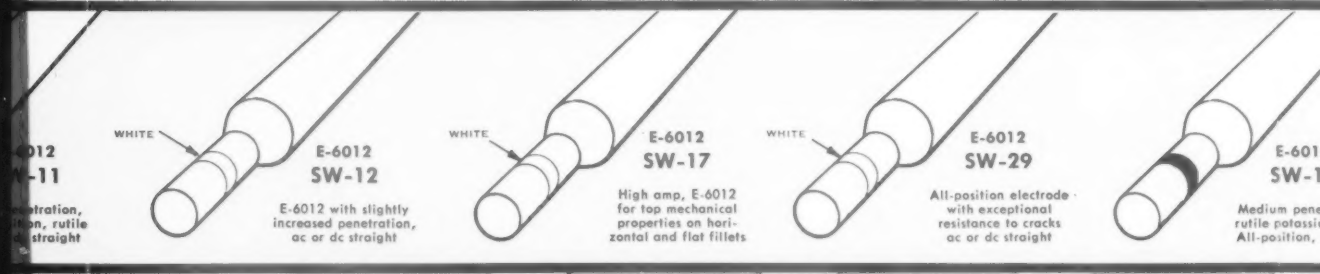
DIAMONDWELD AH-3
For any ferrous base metal, for severe impact and abrasion resistance



DIAMONDWELD AH-4
Iron powder, low hydrogen electrode for high-speed hard surfacing

RS THE INDUSTRY'S MOS

Choose from 87 basic types cov



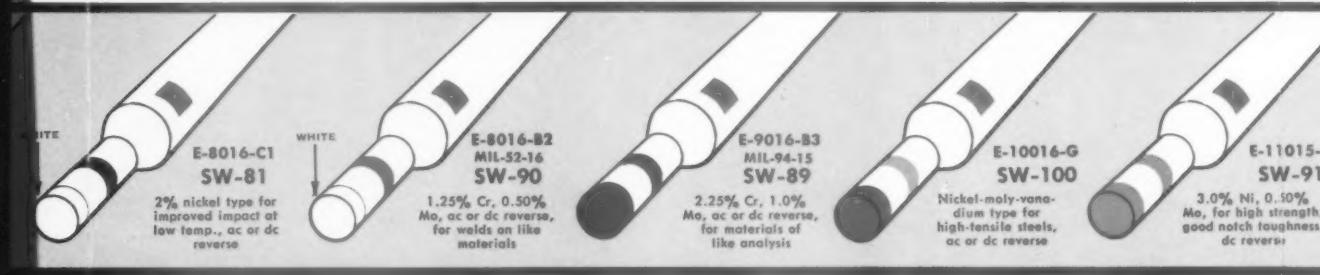
012
-11
etration,
on, rutile
straight

E-6012 SW-12
E-6012 with slightly increased penetration, ac or dc straight

E-6012 SW-17
High amp, E-6012 for top mechanical properties on horizontal and flat fillets

E-6012 SW-29
All-position electrode with exceptional resistance to cracks ac or dc straight

E-601
SW-1
Medium pene
rutile potassi
All-position,



ITE

E-8016-C1 SW-81
2% nickel type for improved impact at low temp., ac or dc reverse

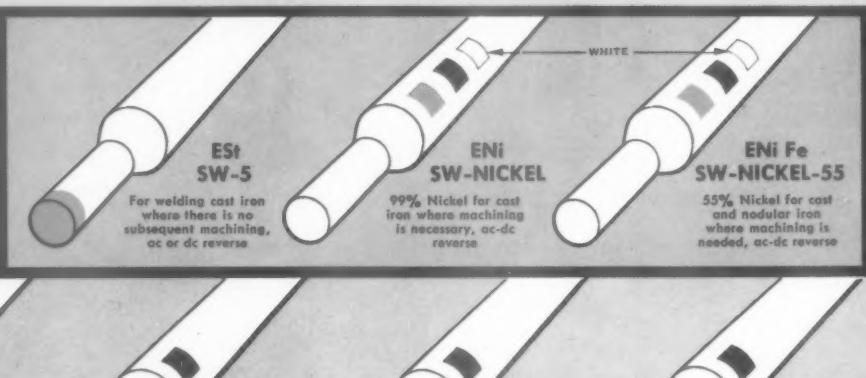
E-8016-B2 MIL-52-16 SW-90
1.25% Cr, 0.50% Mo, ac or dc reverse, for welds on like materials

E-9016-B3 MIL-94-15 SW-89
2.25% Cr, 1.0% Mo, ac or dc reverse, for materials of like analysis

E-10016-G SW-100
Nickel-moly-vanadium type for high-tensile steels, ac or dc reverse

E-11015-
SW-91
3.0% Ni, 0.50% Mo, for high strength good notch toughness dc reverse

CAST IRON



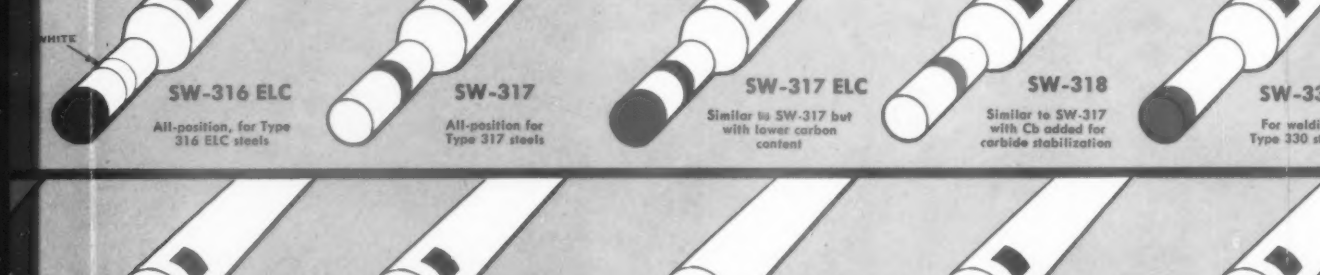
ESt SW-5
For welding cast iron where there is no subsequent machining, ac or dc reverse

ENi SW-NICKEL
99% Nickel for cast iron where machining is necessary, ac-dc reverse

ENi Fe SW-NICKEL-55
55% Nickel for cast and nodular iron where machining is needed, ac-dc reverse

STAINLES

*NOTE—group co
lime and dc titani
color coding for a
more details, ask



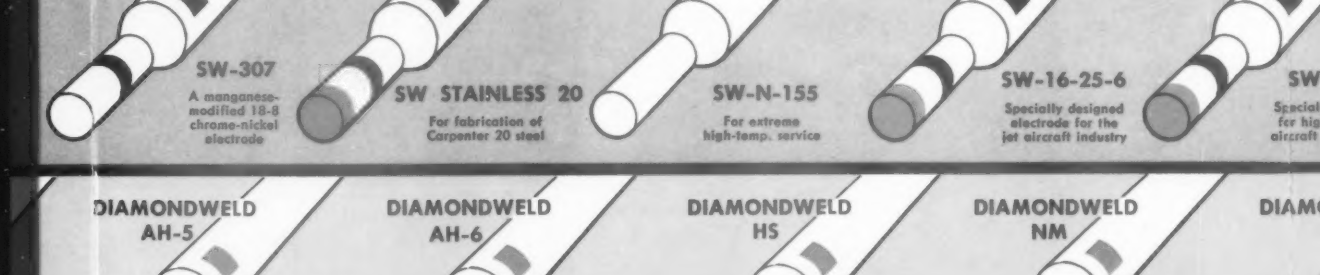
SW-316 ELC
All-position, for Type 316 ELC steels

SW-317
All-position for Type 317 steels

SW-317 ELC
Similar to SW-317 but with lower carbon content

SW-318
Similar to SW-317 with Cb added for carbide stabilization

SW-33
For weldi
Type 330 s



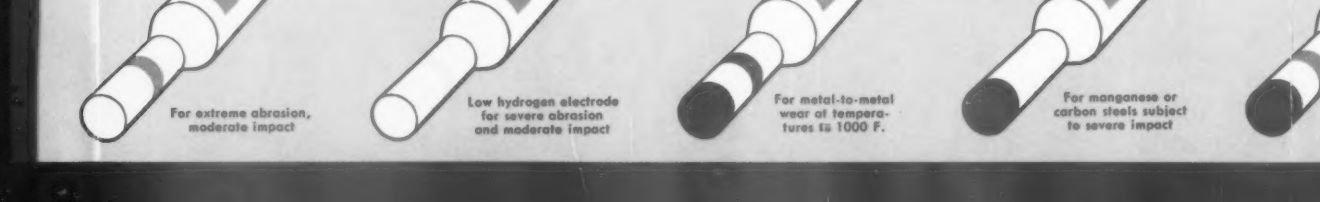
SW-307
A manganese-modified 18-8 chrome-nickel electrode

SW STAINLESS 20
For fabrication of Carpenter 20 steel

SW-N-155
For extreme high-temp. service

SW-16-25-6
Specially designed electrode for the jet aircraft industry

SW
Special
for hig
aircraft



DIAMONDWELD AH-5
For extreme abrasion, moderate impact

DIAMONDWELD AH-6
Low hydrogen electrode for severe abrasion and moderate impact

DIAMONDWELD HS
For metal-to-metal wear at temperatures to 1000 F.

DIAMONDWELD NM
For manganese or carbon steels subject to severe impact

DIAMO

OST COMPREHENSIVE LI

overing all major classifications

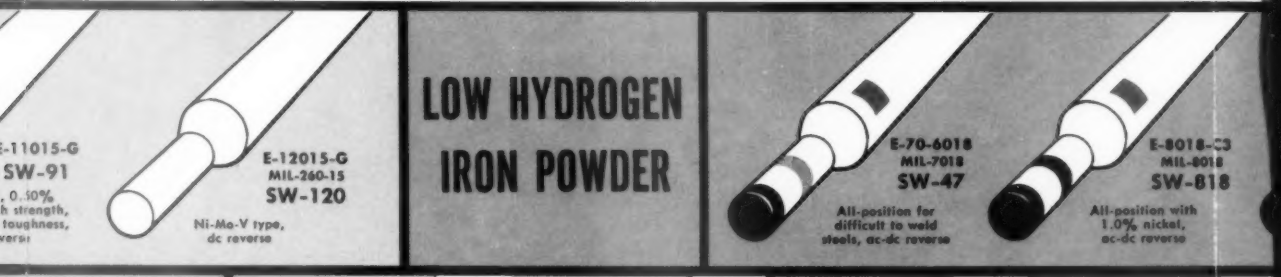
E-6013
SW-15
dium penetration,
le potassium type.
position, ac or dc

E-6013
SW-16
Low penetrating for sheet metal welding, ac or dc

E-6020
SW-35
Iron oxide, fine spray for fillet and downhand, ac or dc

E-6020
SW-37
Modified E-6020 with high deposition rate, ac or dc

Spra
Low
ac



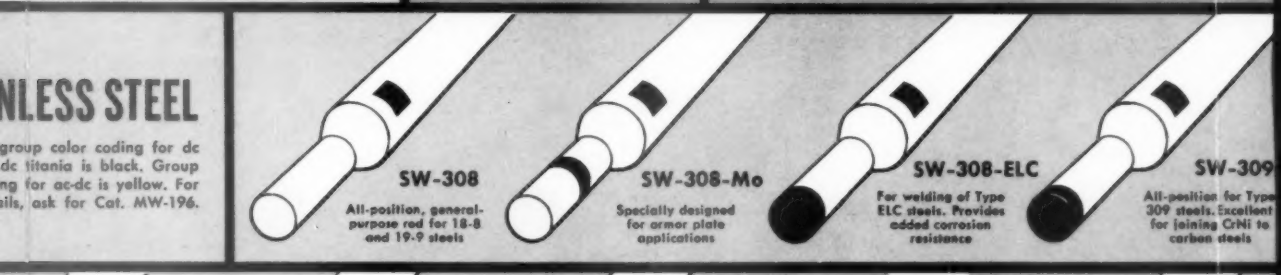
E-11015-G
SW-91
0.50%
h strength,
toughness,
vers

E-12015-G
MIL-260-15
SW-120
Ni-Mo-V type, dc reverse

LOW HYDROGEN IRON POWDER

E-70-6018
MIL-7018
SW-47
All-position for difficult to weld steels, ac-dc reverse

E-8018-C3
MIL-8018
SW-818
All-position with 1.0% nickel, ac-dc reverse



NLESS STEEL

group color coding for dc
dc titania is black. Group
ng for ac-dc is yellow. For
ils, ask for Cat. MW-196.

SW-308
All-position, general-purpose rod for 18-8 and 19-9 steels

SW-308-Mo
Specially designed for armor plate applications

SW-308-ELC
For welding of Type ELC steels. Provides added corrosion resistance

SW-309
All-position for Type 309 steels. Excellent for joining CrNi to carbon steels

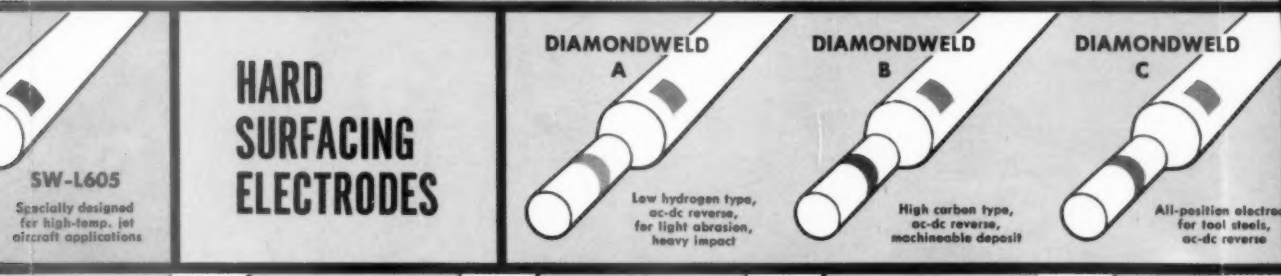
SW-330
For welding
ype 330 steels

SW-347
For Types 347 and 321 steels . . . stabilized

SW-349
For high-temp. applications — jet aircraft

SW-360
For high-temp. applications requiring 15-60 or Nichrome

SW-380
For high-temp. applications requiring 20-80 or Nichrome V.



SW-L605
Specially designed for high-temp. jet aircraft applications

HARD SURFACING ELECTRODES

DIAMONDWELD A
Low hydrogen type, ac-dc reverse, for light abrasion, heavy impact

DIAMONDWELD B
High carbon type, ac-dc reverse, machineable deposit

DIAMONDWELD C
All-position electrod
for tool steels,
ac-dc reverse

DIAMONDWELD GP
For joining or surfacing manganese or carbon steel

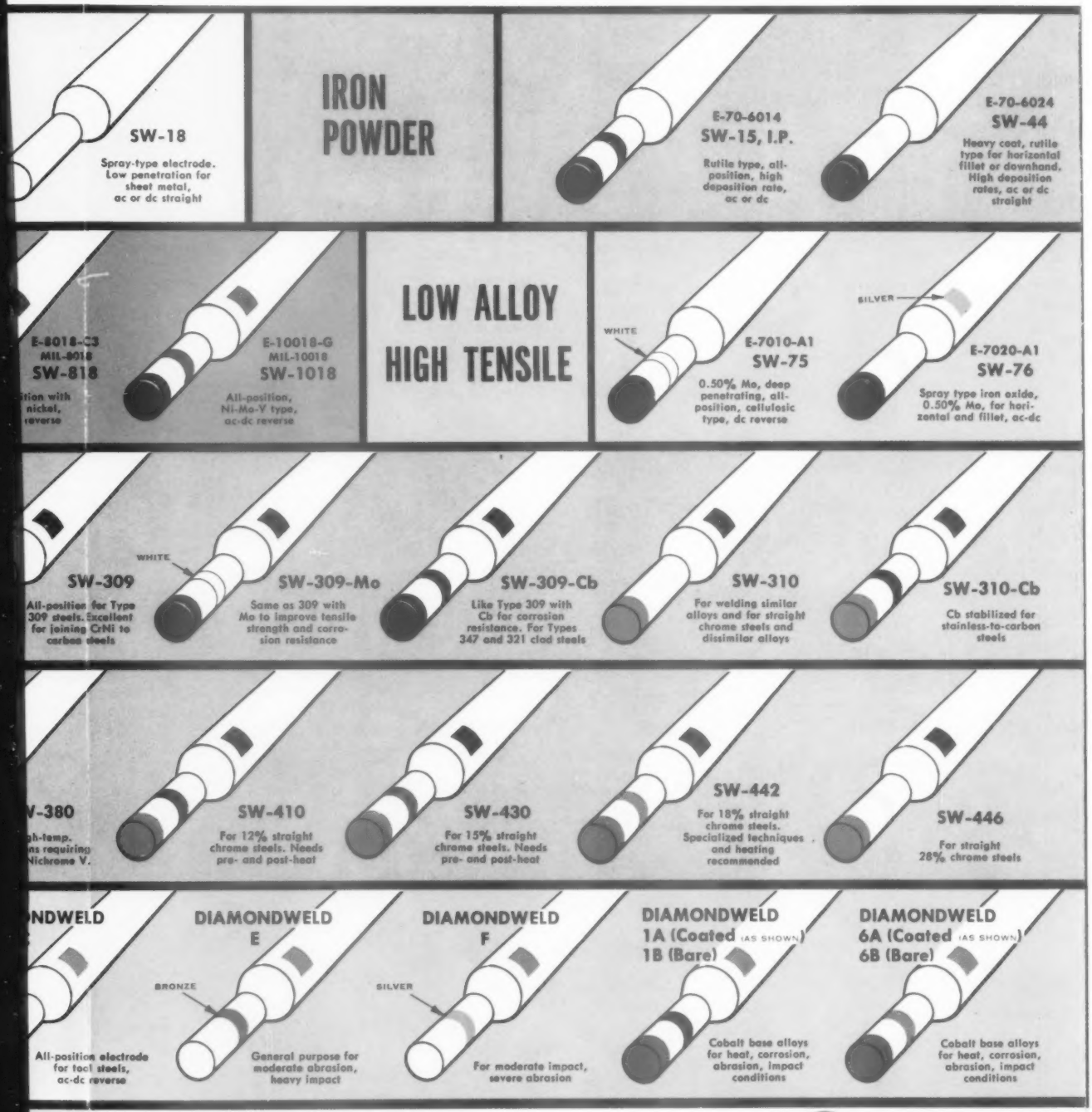
DIAMONDWELD NiMn (Bare-coated)
For manganese carbon steel overlays

DIAMONDWELD TM
For severe impact and severe abrasion

DIAMONDWELD TC
For severe impact and severe abrasion

LINE OF ELECTRODES

ons


SW-18
Spray-type electrode. Low penetration for sheet metal, ac or dc straight
IRON POWDER
E-70-6014
SW-15, I.P.
Rutile type, all-position, high deposition rate, ac or dc
E-70-6024
SW-44
Heavy coat, rutile type for horizontal fillet or downhand. High deposition rates, ac or dc straight
E-8018-C3
MIL-8018
SW-818
E-10018-G
MIL-10018
SW-1018
All-position, Ni-Mo-V type, ac-dc reverse
LOW ALLOY HIGH TENSILE
WHITE
E-7010-A1
SW-75
0.50% Mo, deep penetrating, all-position, cellulosic type, dc reverse
SILVER
E-7020-A1
SW-76
Spray type iron oxide, 0.50% Mo, for horizontal and fillet, ac-dc
SW-309
All-position for Type 309 steels. Excellent for joining CrNi to carbon steels
WHITE
SW-309-Mo
Same as 309 with Mo to improve tensile strength and corrosion resistance
SW-309-Cb
Like Type 309 with Cb for corrosion resistance. For Types 347 and 321 clad steels
SW-310
For welding similar alloys and for straight chrome steels and dissimilar alloys
SW-310-Cb
Cb stabilized for stainless-to-carbon steels
SW-410
For 12% straight chrome steels. Needs pre- and post-heat
SW-430
For 15% straight chrome steels. Needs pre- and post-heat
SW-442
For 18% straight chrome steels. Specialized techniques and heating recommended
SW-446
For straight 28% chrome steels
DIAMONDWELD E
BRONZE
General purpose for moderate abrasion, heavy impact
DIAMONDWELD F
SILVER
For moderate impact, severe abrasion
DIAMONDWELD 1A (Coated) (AS SHOWN) 1B (Bare)
Cobalt base alloys for heat, corrosion, abrasion, impact conditions
DIAMONDWELD 6A (Coated) (AS SHOWN) 6B (Bare)
Cobalt base alloys for heat, corrosion, abrasion, impact conditions

Plus automatic wires to meet every need —

A. O. Smith also offers a line of wires for automatic and semi-automatic welding for all types of steels. They include:

MILD STEEL — CO-85, CO-86. Designed particularly for carbon-dioxide shielded arc welding processes • **STAINLESS** — 308, 308 ELC, 309, 310, 316, 316 ELC, 330, 347, 321, 2 Cr Mo, 502, 410, 430, 446, 349, 312, Stainless 20 • **HARD FACING** — Gp 600, AH 100, NM 700, AH 500, AH 300, AH 300, AH 420.

Through research . . . a better way

A.O.Smith

CORPORATION

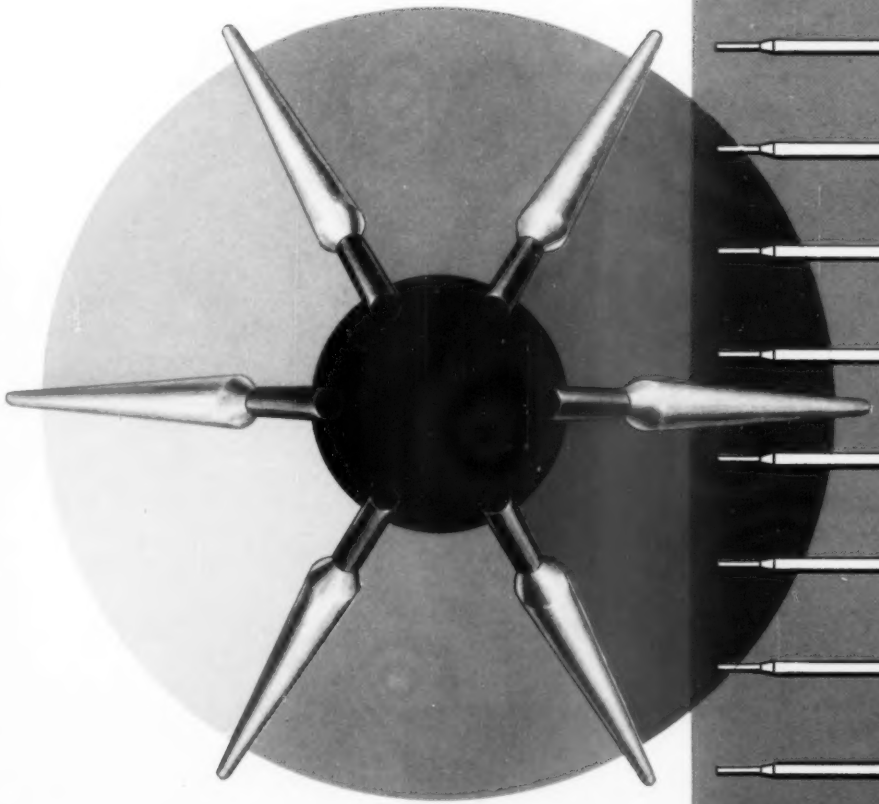
WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith INTERNATIONAL S. A. Milwaukee 1, Wis., U. S. A.

NOW... *from* A. O. Smith

NEW ELECTRODE CATALOG –KEYED TO NEW A.W.S. SPECIFICATIONS AND NEW NEMA COLOR CODE



HERE'S MORE D

MILD STEEL

E 6010 **MIL-6010** **SW-10** **dc reverse**

All position. High cellulosic coating. Deep penetrating or cutting arc.

PROCEDURE: Horizontal and downhand welding: hold a medium to short arc, tilted 5° to 15° in direction of travel. Weave with a slightly oscillating motion, hesitating at the edges to insure proper fusion. Clean each bead before depositing next. Vertical and overhead welding: for best results hold electrode perpendicular to the work. Weaving of the electrode should be limited to allow only time enough for molten metal to set up.

	As Welded	Stress Relieved
Yield Point psi	59,200	53,800
Tensile Strength psi	71,150	67,600
% Elongation in 2"	29.9	34.5

X-Ray Quality

C	Mn	P	S	Si
.08	.47	.022	.026	.21

Complies with:
U. S. Navy — Spec. MIL-E-15599
A. B. S. — E 6010
U. S. Coast Guard
Lloyds Register of Shipping

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	7/32"	1/4"
length	14"	14"	14"	18"	18"
amperes — flat	110-130	140-160	170-190	220-250	240-300
amperes — vertical	110-120	130-140	150-170		
amperes — overhead	110-120	135-140	165-175		
volts	25-27	27-29	27-29	28-30	28-32

MILD STEEL

E 6020 **SW-37** **ac—dc**

An exceptionally high-speed iron oxide electrode for downhand and horizontal fillet welding. Produces less concave fillets and smooth finish pass welds at high speeds with high ductility and notch toughness.

PROCEDURE: Open arc with short arc for downhand welds, and open arc or drag technique for fillet welding. Tilt electrode in direction of travel to maintain slag-free puddle.

	As Welded	Stress Relieved
Yield Point psi	52,000	62,000
Tensile Strength psi	65,000	73,000
% Elongation in 2"	29.0	31.0

X-Ray Quality

C	Mn	P	S	Si
.09	.42	.015	.025	.25

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	7/32"	1/4"	5/16"
length	18"	18"	18"
amperes	280-310	300-350	370-410
volts	32-35	33-36	35-38

LOW HYDROGEN

E 9016 B3 **MIL 94-15** **SW-89** **ac—dc reverse**

A low hydrogen type electrode designed for welding 2.25% Cr-1.0% Mo steels. Outstanding for welding of high-pressure, high-temperature piping found in power houses.

PROCEDURE: Pre- and post-heat treatment to job specification. Tilt electrode 5° to 15° in direction of travel. Hold short arc. Use weaving or beading technique. Important to clean crater before restriking. Restrike in center of crater and move back toward previous bead. Then reverse direction.

Yield Point psi	81,550
Tensile Strength psi	95,800
% Elongation in 2"	22.0

X-Ray Quality

C	Mn	P	S	Si	Cr	Mo
.05	.65	.020	.029	.48	2.21	1.18

Complies with:
A. B. S. — Class E 9016 B3
U. S. Coast Guard — Class E 9016 B3
U. S. Navy — MIL-E-16589
MIL-94-15

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"
length	14"	14"	14"
amperes — flat	120-170	160-200	195-260
amperes — vertical	90-120	110-140	140-170
amperes — overhead	100-130	130-160	170-200
volts	23-24	24-25	25-26

LOW ALLOY — HIGH TENSILE

E 7013 G **SW-85** **ac—dc**

An all-position, rutile electrode with excellent handling characteristics for welding high tensile steels.

This electrode has been used with great success on high tensile steels and on high pressure, high temperature chrome-moly piping.

PROCEDURE: Pre- and post-heat treatment in accordance with job specifications. For flat welds—tilt 5° to 15° in direction of travel. Hold medium length arc. For horizonal fillets—tilt 5° to 15° in direction of travel at angle bisecting the vertical and base plate. Hold medium length arc.

	As Welded
Yield Point psi	73,000
Tensile Strength psi	83,000
% Elongation in 2"	22.0

X-Ray Quality

C	Mn	Si	Mo
.09	.45	.45	.55

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"
length	14"	14"	14"
amperes — flat	120-130	150-165	190-220
amperes — vertical	110-115	135-160	170-185
amperes — overhead	110-120	145-165	170-185
volts	23-25	25-27	26-28

MILD

E 6011 **SW-14** **ac—dc**

All-position cellulosic electrode. Produces easily controlled force with deep penetration. "Hot strength" characteristics guard against

PROCEDURE: Hold a medium to short arc tilted 5° to 15° in the d of travel, with the electrode at an angle of 45° to each plate. Wea slight oscillating motion, hesitating at the edges to insure proper Clean each bead before depositing next.

	As Welded	Stress Relieved
Yield Point psi	65,500	55,100
Tensile Strength psi	75,500	66,400
% Elongation in 2"	26.5	33.5

X-Ray Quality

C	Mn	P	S	Si
.07	.40	.020	.025	.10

Complies with:
A. B. S. — E 6011
Lloyds Register of Shippi
U. S. Coast Guard

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	3/32"	1/8"	5/32"	3/16"	7/32"
length	12"	14"	14"	14"	18"
amperes — flat	70-80	100-130	130-160	155-190	175-220
amperes — vertical	60-70	100-120	130-150	155-180	
amperes — overhead	60-70	100-120	130-150	160-180	
volts	22-24	25-27	27-29	29-31	30-32

MIL

Not Classified **SW-18** **ac—dc**

A mineral type electrode for high-speed welding of sheet met electrode for welding vertically down. Also excellent for lap wel izontal fillet welds, skip welds and tacking for set-up, because lent restriking characteristics.

PROCEDURE: For flat or overhead welds—tilt electrode 5° to 15° tion of travel. Hold very short arc, preferably using a drag we nique. For welding vertically down use drag technique, tilting 15° to 30° in direction of travel.

	As Welded
Yield Point psi	57,000
Tensile Strength psi	66,500
% Elongation in 2"	23.5

C	Mn	P	S
.10	.42	.023	.022

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"
length	14"	14"	14"
amperes — flat	110-140	130-160	200-240
amperes — vertical down	120-150	140-180	210-250
amperes — overhead	110-140	120-150	180-220
volts	22-24	23-25	24-26

LOW HY

E 10016 G **SW-100** **ac—dc**

The low hydrogen type coating is balanced to provide extreme handling and excellent physical properties required for armor pla high ductility and unusually good impact values.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hold s Use weaving or beading technique. Important to clean crater be striking. Restrike in center of crater and move back toward bead. Then reverse direction.

	As Welded
Yield Point psi	94,500
Tensile Strength psi	105,000
% Elongation in 2"	22.5

X-Ray Quality

C	Mn	P
.07	1.00	.020
Si	Mo	V
.23	.42	.10

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	
length	14"	14"	
amperes — flat	120-170	160-200	1
amperes — vertical	90-120	110-140	1
amperes — overhead	100-130	130-160	1
volts	23-24	24-25	

LOW ALLOY — HIGH

E 8013 B2 **SW-88**

An all-position, rutile electrode with excellent handling chara for welding high tensile steels.

This electrode has been used with great success on high tens and on high pressure, high temperature chrome-moly piping.

PROCEDURE: Pre- and post-heat treatment in accordance with jo cations. For flat welds—tilt 5° to 15° in direction of travel. Hold length arc. For horizonal fillets—tilt 5° to 15° in direction of angle bisecting the vertical and base plate. Hold medium length

	As Welded
Yield Point psi	102,000
Tensile Strength psi	113,850
% Elongation in 2"	17.0

X-Ray Quality

C	Mn	Si	Cr
.09	.43	.50	1.4

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	
length	14"	14"	
amperes — flat	120-130	150-165	
amperes — vertical	110-115	135-160	
amperes — overhead	110-120	145-165	
volts	23-25	25-27	

DETAILED INFORMAT

MILD STEEL

ac—dc reverse
ed forceful arc
d against cracks.
n the direction
ate. Weave with
e proper fusion.

ith:
011
of Shipping
ard

E:

32"	1/4"	
8"	18"	
-220	225-260	
0-32	31-33	

MILD STEEL

E 6012 **SW-11** **ac—dc straight**

High rutile electrode. Good on poor fit-up. For use in welding jobs calling for a "cold" E-6012 electrode. Outstanding in vertical down applications.

PROCEDURE: Hold a short arc or lightly touch coating to work, holding sufficient current so electrode does not stick, with the electrode tilted 5° to 15° in the direction of travel. For vertical welding, weld from the bottom up for heavy beads and down for small beads.

	As Welded	Stress Relieved
Yield Point psi	65,900	64,100
Tensile Strength psi	76,000	74,800
% Elongation in 2"	18.5	19.0

Complies with:
A. B. S. — E 6012
U. S. Coast Guard

C	Mn	P	S	Si
.07	.30	.022	.025	.20

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		3/32"	1/8"	5/32"	3/16"	1/4"
length		12"	14"	14"	14"	18"
amperes	flat	70-80	120-140	160-185	200-240	280-330
	vertical	60-75	110-120	140-165	160-185	
	overhead	60-75	110-120	140-160	160-185	
volts		21-23	24-25	25-26	26-27	26-27

E 6012 **SW-12** **ac—**

A high rutile electrode — good on poor fit-up. Designed as a "
electrode useful in applications where the upper end of th
range is employed.
Widely used for pipe booms • ship bulkheads • shaft tunnels •
base forms • electrical switch gears • tanks and headers • ma
all types • steel houses.

PROCEDURE: Hold a short arc or lightly touch coating to
sufficient current so electrode does not stick. Tilt electrode 5
the direction of travel. For vertical welding, weld from the

	As Welded	Stress Relieved
Yield Point psi	65,900	64,100
Tensile Strength psi	76,000	74,800
% Elongation in 2"	18.5	19.0

C	Mn	P
.07	.30	.022

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		1/8"	5/32"	3/16"
length		14"	14"	14"
amperes	flat	120-140	160-185	200-240
	vertical	110-120	140-165	160-185
	overhead	110-120	140-160	160-185
volts		24-25	25-26	26-27

MILD STEEL

ac—dc straight
eet metal. Best
lap welds, hor-
ecause of excel-

to 15° in direc-
drag weld tech-
tilting electrode

	S	Si
23	.022	.02

E:

	7/32"	
	18"	
	260-310	
	25-27	

IRON POWDER

E 70-6014 **SW-15 IP** **ac—dc**

A high-speed medium-heavy coated iron powder all-position electrode with sufficient penetration to assure root fusion and eliminate porosity in fillets. Designed for general-purpose welding where full positioning is not practical. Assures equal leg fillets to eliminate necessity of over-welding. Self-cleaning slag.

PROCEDURE: Open or drag technique may be used. Use medium to short arc on open arc and in both methods vary angle of electrode in direction of travel.

	As Welded	Stress Relieved
Yield Point psi	52,000	62,000
Tensile Strength psi	65,000	73,000
% Elongation in 2"	25.0	31.0

Complies with:
A. B. S. — E 70-6014
U. S. Coast Guard

X-Ray Quality

C	Mn	P	S	Si
.09	.40	.015	.025	.23

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"
length		12"	14"	14"	14"	18"	18"	18"
amperes	flat	70-100	120-150	160-200	230-270	290-330	340-400	400-440
	vertical	65-80	100-120	160-180	190-210			
	overhead	70-90	120-130	160-180	210-230			
volts		22-24	22-24	22-26	22-26	24-28	24-28	26-28

IRO

E 70-6024 **SW-44** **ac—**

A high-speed, heavy-coated, iron powder bearing, minera
trode for high deposition rates on horizontal and downhand w
duces an equal-leg 45° fillet to eliminate overwelding. Exc
appearance with self-cleaning slag. Large fillets (up to 5/16") c
with absolutely no undercut.

PROCEDURE: Drag technique should be used on horizontal an
fillets. Tilt electrode 5° to 10° in direction of travel and 40°
base plate. No weaving necessary.

	As Welded
Yield Point psi	75,000
Tensile Strength psi	87,500
% Elongation in 2"	25.0

Complies with:
A. B. S. — E 70-6024

C	Mn	P	S	Si
.09	.74	.030	.020	.80

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	7/32"
length	14"	14"	18"	18"
amperes	150-180	180-220	250-280	300-340
volts	33-35	34-36	36-38	37-39

OW HYDROGEN

ac—dc reverse
extreme ease in
rmor plate work,

Hold short arc.
rater before re-
oward previous

y Quality

P	S
.020	.022

V	Ni
.10	1.70

GE:

5/16"	
14"	
195-260	
140-170	
170-200	
25-26	

LOW HYDROGEN

E 11015 G **SW-91** **dc reverse**

For all-position welding of Carilloy T-1 steel and high-tensile steels such as armor plate and other heat treated steel requiring high notch bar impact values.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hold short arc. Weaving or beading technique. Restrike in center of crater and move back toward previous bead. Then reverse direction.

	As Welded	Stress Relieved*
Yield Point psi	100,000	100,000
Tensile Strength psi	110,000	112,000
% Elongation in 2"	22.0	20.0
Keyhole Charpy ft. lbs. @ —65 F	32.0	26.0
V-Notch Charpy ft. lbs. @ —65 F	23.0	24.0

*Stress relieved at 1150F for one hour, furnace cooled.

X-Ray Quality

C	Mn	Si	Ni	Mo
.05	.94	.29	3.0	.62

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		1/8"	5/32"	3/16"	7/32"	1/4"
length		14"	14"	14"	18"	18"
amperes	flat	120-170	160-200	195-260	230-310	280-350
	vertical	90-120	110-150			
	overhead	100-130	130-160			
volts		23-24	24-25	25-26	26-27	26-28

LOW

E 12015G **MIL-260-15** **SW-120**

For armor plate and non-heat-treated cast armor and high
alloy steels. This electrode has a heavy, low hydrogen type
produces a weld metal of unusually high ductility in th
condition.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hol
Use weaving or beading technique. Important to clean crate
striking. Restrike in center of crater and move back towa
bead. Then reverse direction.

	As Welded
Yield Point psi	114,000
Tensile Strength psi	123,500
% Elongation in 2"	20.5

X-Ray Qualit

Complies with:
U. S. N. — MIL-E-986

C	Mn	Si	Mo	V	Ni
.06	1.04	.34	.98	.27	1.76

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		1/8"	5/32"
length		14"	14"
amperes	flat	120-170	160-200
	vertical	90-120	110-140
	overhead	100-130	130-160
volts		23-24	24-25

— HIGH TENSILE

ac—dc
g characteristics

gh tensile steels
piping.
with job specifi-
el. Hold medium
tion of travel at
length arc.

Quality

	Cr	Mo
i	1.45	.62
50		

GE:

3/16"	
14"	
190-220	
170-185	
170-185	
26-28	

LOW ALLOY — HIGH TENSILE

E 9010 G **SW-95** **dc reverse**

For maintenance and repair work particularly where rust, paint and scale are present. Will burn through rust, paint and scale when most other electrodes fail.

PROCEDURE: Horizontal and downhand — hold medium to close arc, with electrode tilted 5° to 15° in direction of travel. Weave with oscillating motion hesitating at edges. Clean each bead. Vertical and overhead welding — hold electrode perpendicular to work. Weaving should be limited to allow only time enough for set up.

	As Welded	Stress Relieved
Yield Point psi	91,500	87,650
Tensile Strength psi	102,500	98,150
% Elongation in 2"	16.0	18.5

X-Ray Quality

C	Mn	P
.12	.65	.02
S	Si	V
.025	.30	15

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter		1/8"	5/32"	3/16"
length		14"	14"	14"
amperes	flat	110-120	140-160	170-180
	vertical	110-120	130-140	140-160
	overhead	110-120	130-140	140-170
volts		25-27	26-28	27-29

LOW ALLOY — H

E 12020 G **SW-101** **ac—**

A mineral type of electrode for both deep groove welding an
and horizontal fillet welds in high-tensile steels.

PROCEDURE: Preheat to 350° to 450°F and maintain this temp
welding is completed. Immediately follow with stress reliev
plete heat treatment as required. For flat welds—tilt 5° to
tion of travel. Hold short to medium arc. For horizontal fille
15° in direction of travel bisecting the vertical and base
short arc.

	As Welded	Stress Relieved	Heat* Treated
Yield Point psi	111,300	124,400	124,450
Ten. Strength psi	129,400	131,850	133,150
% Elong. in 2"	14.5	17.5	17.5

*Heat Treatment—Heat at 1650 F for 2 hours, oil quench, temper at 1165 F for 2 hours, air cool.

X-Ray Qua

C	Mn	P
.12	.50	.022

Cr	Ni	Mo
.42	1.71	.7

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"
length	14"	14"	14"
amperes	120-150	160-185	200-230
volts	26-28	28-30	30-32

MATION ON BEST SE

MILD STEEL

-12 **ac—dc straight**

n poor fit-up. Designed as a "hot" E-6012 where the upper end of the amperage

ip bulkheads • shaft tunnels • machinery ears • tanks and headers • machinery of

or lightly touch coating to work, using oes not stick. Tilt electrode 5° to 15° in tical welding, weld from the bottom up.

ss Relieved

C	Mn	P	S	Si
64,100				
74,800	.07	.30	.022	.025	.20
19.0				

ERAGE AND VOLTAGE RANGE:

5/32"	3/16"	1/4"
14"	14"	18"
0-185	200-240	280-330
0-165	160-185	
0-160	160-185	
5-26	26-27	26-27

MILD STEEL

E 6012 **SW-17** **ac—dc straight**

A high rutile type electrode for heavy production welding, where fit-up is poor and high ductility and high mechanical properties are desired. Can be used with high amperages.

Built-in toughness is one of its outstanding characteristics. Ideal for high production work because higher amperage can be used. It is used at welding currents 30 to 40 amps higher than ordinary E 6012 electrodes.

PROCEDURE: For flat welds tilt electrode 5° in the direction of travel, hold medium to short arc. For horizontal fillets tilt electrode 5° to 10° in direction of travel at angle bisecting vertical and base plate. Hold medium to short arc.

	As Welded	Stress Relieved
Yield Point psi	61,450	55,200
Tensile Strength psi	71,950	66,600
% Elongation in 2"	26.0	27.5

C	Mn	P	S	Si
.07	.35	.021	.027	.10

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	7/32"	1/4"
length	14"	14"	14"	18"	18"
amperes	120-150	160-195	210-275	260-340	290-400
volts	25-27	26-28	27-29	28-30	28-30

E 6012 **SW-**

A high rutile, high production ele where weld cracking is a problem

PROCEDURE: May be used with ei however, will permit slightly gre For best results hold a short arc direction of travel. For vertical w a small bead is desired, welding r bead before welding next pass.

	As Welded	Stress
Yield Point psi	65,900	64
Tensile Strength psi	76,000	74
% Elongation in 2"	17.5	

RECOMMENDED AMPER

diameter	1/8"	5/32"	
length	14"	14"	
amperes: flat	120-140	160-185	
amperes: vertical	110-120	140-165	
amperes: overhead	110-120	140-160	
volts	24-25	25-26	

IRON POWDER

-44 **ac—dc straight**

n powder bearing, mineral-type elec- horizontal and downhand welding. Pro- eliminate overwelding. Excellent bead g. Large fillets (up to 3/8") can be made

d be used on horizontal and downhand direction of travel and 40° to 50° from /.

elded

5,000	
7,500	
25.0	

Complies with:
A. B. S. — E 70-6024

Si
.80

ERAGE AND VOLTAGE RANGE:

	3/16"	7/32"	1/4"
	18"	18"	18"
	250-280	300-340	350-400
	36-38	37-39	38-40

LOW HYDROGEN

E 70-6016 **MIL-7016** **SW-65** **ac—dc reverse**

A lime ferritic electrode particularly adaptable for welding steels of high sulphur content and steels of poor weldability. Also used for welding low alloy and high carbon steels without preheating, and steels that are to be enameled after welding. In many cases, it will solve cracking, porosity and similar problems encountered with regular mild steel electrodes.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hold short arc. Use weaving or beading technique. Important to clean crater. Restrike in center. Move back toward previous bead. Then reverse direction and continue.

	As Welded	Stress Relieved
Yield Point psi	64,450	63,150
Tensile Strength psi	74,300	72,350
% Elongation in 2"	32.0	32.5

X-Ray Quality

Complies with:
U. S. N. Type MIL-7016, MIL-E-18038
A. B. S. — E 70-6016
U. S. Coast Guard

C	Mn	P	S	Si
.08	.79	.021	.017	.23

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"
length	12"	14"	14"	14"	18"	18"
amperes: flat	80-100	120-170	160-200	195-260	260-310	280-350
amperes: vertical	70-100	90-120	110-140	140-170		
amperes: overhead	70-100	100-130	130-160	170-200		
volts	22-23	23-24	24-25	25-26	26-27	26-28

LOW HYDROGEN

E 7016G **SW**

A 1.0% nickel electrode with lo cellent manipulative characteri ductile weld metal. The bead is

PROCEDURE: Tilt electrode 5° to 1 Use weaving or beading techniqu restriking. Restrike in center of bead. Then reverse direction and

	As Welded	Stres
Yield Point psi	71,250	6
Tensile Strength psi	80,700	7
% Elongation in 2"	31.5	

RECOMMENDED AMPE

diameter	5/32"	
length	14"	
amperes: flat	160-200	
amperes: vertical	110-140	
amperes: overhead	130-160	
volts	24-25	

LOW HYDROGEN

SW-120 **dc reverse**

reated cast armor and high tensile-low heavy, low hydrogen type coating that sually high ductility in the as-welded

5° in direction of travel. Hold short arc. ue. Important to clean crater before re- crater and move back toward previous

elded

4,000	X-Ray Quality
3,500	
20.5	

Complies with:
U. S. N. — MIL-E-986 — MIL-260

Ni
.76

RAGE AND VOLTAGE RANGE:

	5/32"	3/16"
	14"	14"
	160-200	195-260
	110-140	140-170
	130-160	170-200
	24-25	25-26

LOW HYDROGEN IRON POWDER

E 70-6018 **MIL-7018** **SW-47** **ac—dc reverse**

An all-position electrode which combines the advantages of low hydrogen for welding difficult-to-weld steels, and iron powder with its ease of handling, reduction of starting porosity and higher deposition rates.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Use weaving or beading technique, cleaning craters before restriking. Restrike electrode ahead of crater and move back to previous bead.

	As Welded	Stress Relieved
Yield Point psi	70,000	65,000
Tensile Strength psi	82,500	77,000
% Elongation in 2"	33.0	35.0
Stress relieved at 1150 F		

X-Ray Quality

Complies with:
A. B. S. — E 70-6018
U. S. Navy — MIL-7018, MIL-E-19322

C	Mn	P	S	Si
.08	.72	.013	.020	.80

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"
length	12"	14"	14"	14"	18"	18"	18"
amperes: flat	90-110	120-160	190-220	230-270	290-330	340-380	425-475
amperes: vertical	70-90	110-140	130-170	165-180			
amperes: overhead	80-100	120-140	130-170	165-180			
volts	19-23	20-21	21-22	22-23	23-24	23-24	24-25

E 8018 C3 **MIL-8018**

A 1% nickel electrode combining powder low hydrogen coating ments to produce 80,000 psi m notch toughness.

PROCEDURE: Tilt electrode 5° to or beading technique, cleaning trode ahead of crater and move

	As Welded	Stress
Yield Point psi	80,000	7
Tensile Strength psi	91,500	9
% Elongation in 2"	22.0	
V-Notch Charpy ft. lbs. @ —40 F	37.0	

*Stress relieved at 1150 F for two hour nace cooled.

RECOMMENDED AMPE

diameter	1/8"	5/32"
length	14"	14"
amperes: flat	120-150	180-220
amperes: vertical	110-140	140-170
amperes: overhead	120-140	140-170
volts	22-23	22-23

LOW ALLOY — HIGH TENSILE

-101 **ac—dc straight**

oth deep groove welding and positioned -tensile steels.

)°F and maintain this temperature until ly follow with stress relieving or com- For flat welds—tilt 5° to 15° in direc- um arc. For horizontal fillets—tilt 5° to ing the vertical and base plate. Hold

at* ated

,450			X-Ray Quality		
,150	C	Mn	P	S	Si
17.5	.12	.50	.022	.026	.20
ours,	Cr	Ni	Mo	V	
, air	.42	1.71	.72	.16	

ERAGE AND VOLTAGE RANGE:

/32"	3/16"	1/4"
4"	14"	18"
0-185	200-230	280-310
3-30	30-32	32-34

CAST IRON

ESt **SW-5** **ac—dc reverse**

An inexpensive steel shielded-arc electrode designed especially for welding any type of cast iron when machinability is not required. Extremely good arc characteristics permit use of low amperage, thus reducing the usual hardened zone along the line of fusion. This low heat also lessens the admixture of cast iron.

Widely used for foundry repairing of malleable castings before anneal • build-up and repair of gray iron • cracked cast iron boiler sections • cracked cylinder heads and blocks.

PROCEDURE: Work should have oil, paint, grease and dirt removed before welding.

diameter	1/8"
length	14"
amperes	80-100
volts	21-23

ENi **SW-Ni**

A flux-coated electrode with a cast iron when sound, machinab tionally smooth with practical about the same as it would be metal is excellent. It "washes" giving a strong fusion with low removed. Weld metal fuses thor not spall out. Widely used for worn parts • filling out undersiz cuts and casting flaws.

PROCEDURE: Can be used in any In cold weather, a moderate p machining requirements are sev ed. It is also advisable to retar with a blanket or other insulati

RECOMMEND

diameter	3/32"	
length	14" c.g.	
amperes	50-90	

ELLING A. O. SMITH

MILD STEEL

SW-29 ac—dc straight

tion electrode especially adapted for welding problem. Also good for poor fit-up work. with either polarity on dc. Straight polarity, htly greater speeds with a lower spatter loss. hort arc with the electrode tilted 5° to 15° in rtical welding weld from the bottom up. Where elding may be done vertical down. Clean each pass.

ded Stress Relieved						
00	64,100	C	Mn	P	S	Si
00	74,800	.07	.30	.022	.025	.20
7.5	19.0					

ED AMPERAGE AND VOLTAGE RANGE:

/32"	3/16"	7/32"	1/4"	5/16"
4"	14"	18"	18"	18"
-185	200-240	260-310	280-330	380-440
-165	160-185			
-160	160-185			
-26	26-27	26-27	26-27	26-28

MILD STEEL

E 6013 SW-15 ac—dc

Finest universal, high-production electrode in industry with range of applications from light gauge to heavy plate. High heat and speeds can be used without undercut. Slag easy to clean and in vertical, overhead or flat work on heavy plate, the slag will peel off weld by itself.

PROCEDURE: For flat welds — tilt 5° to 10° in direction of travel. Medium arc. Horizontal fillets — tilt 5° to 15° in direction of travel at angle bisecting vertical and base plate. Arc of medium to short length. Vertical up — use a weaving "U" or "V" arc motion, hold medium to short arc. Overhead — use circular motion. Medium to short arc.

	As Welded	Stress Relieved
Yield Point psi	67,900	65,000
Tensile Strength psi	76,400	72,700
% Elongation in 2"	21.5	24.5

Complies with:
A. B. S. — E 6013
U. S. Coast Guard
Lloyds Register of Shipping

X-Ray Quality

C	Mn	P	S	Si
.10	.54	.020	.027	.45

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

	diameter	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"
	length	12"	14"	14"	14"	18"	18"	18"
amperes	flat	70-80	120-135	160-180	200-250	280-320	300-360	370-410
	vertical	60-75	120-130	145-175	170-185			
	overhead	60-75	120-135	150-180	180-200			
	volts	21-23	23-25	25-27	26-28	27-29	30-31	30-32

E 6013

All position. Arc e gauges. Particular Ideal on light gau

PROCEDURE: For fla Horizonal fillets — vertical and base travel. Hold short

Yield Point psi -
Tensile Strength psi -
% Elongation in 2" -

X-Ray Q

C	Mn	P
.10	.42	.02

RECOM

	diameter	3/32"
	length	12"
amperes	flat	60-80
	vertical	60-80
	overhead	60-80
	volts	19-22

LOW HYDROGEN

SW-84 ac—dc reverse

with low hydrogen type coating, producing exaracteristics and depositing sound, extremely bead is uniform and slag is easily removable. 5° to 15° in direction of travel. Hold short arc. echnique. Very important to clean crater before enter of crater and move back toward previous tion and continue.

ded Stress Relieved		X-Ray Quality		
250	66,100	C	Mn	P
700	75,200	.08	.77	.015
1.5	34.0	S	Si	Ni
		.017	.20	.96

ED AMPERAGE AND VOLTAGE RANGE:

"	3/16"	1/4"
	14"	18"
00	195-260	280-350
40	140-170	
60	170-200	
5	25-26	26-28

LOW HYDROGEN

E 7016 A1 SW-79 ac—dc reverse

For all-position welding of carbon-moly and low alloy-high tensile steels. This 0.50 molybdenum electrode has a low hydrogen type coating. Arc action is quiet, stable and easy to handle. Bead appearance is uniform; slag is easily removable. Weld metal deposited is sound and extremely ductile.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hold short arc. Use weaving or beading technique. Very important to clean crater before restriking. Restrike in center of crater and move back toward previous bead. Then reverse direction.

	As Welded	Stress Relieved	X-Ray Quality		
Yield Point psi	68,100	73,000	C	Mn	P
Tensile Strength psi	81,100	84,500	.08	.60	.020
% Elongation in 2"	27.0	29.5	S	Si	Mo
			.025	.29	.57

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

	diameter	5/32"	3/16"	1/4"
	length	14"	14"	18"
amperes	flat	160-200	195-260	280-350
	vertical	110-140	140-170	
	overhead	130-160	170-200	
	volts	24-25	25-26	26-28

E 8016 C1

A 2.0% nickel ele duces a smooth in fabrications of and high-impact v

PROCEDURE: Tilt ele Use weaving or be striking. Restrike bead. Then revers

Yield Point psi -
Tensile Strength psi -
% Elongation in 2"

RECO

	diameter	
	length	
amperes	flat	
	vertical	
	overhead	
	volts	

LOW HYDROGEN IRON POWDER

-8018 SW-818 ac—dc reverse

mbining the manipulative advantages of the iron oating with the correct balance of alloying ele- psi minimum tensile with high ductility and

e 5° to 15° in direction of travel. Use a weaving leaning craters before restriking. Restrike elec- d move back to previous bead.

ded Stress Relieved*		X-Ray Quality			
,000	79,500	C	Mn	Si	P
,500	91,800	0.07	0.80	0.74	0.013
22.0	20.0				
37.0	26.0	S	Ni		Mo
two hours, fur-		0.020	0.90		.18

ED AMPERAGE AND VOLTAGE RANGE:

5/32"	3/16"	7/32"	1/4"
14"	14"	18"	18"
180-220	230-270	290-320	330-370
140-170	160-180		
140-170	170-190		
22-23	22-23	23-24	23-24

LOW HYDROGEN IRON POWDER

E 10018 MIL-10018 SW-1018 ac—dc reverse

Combines the manipulative advantages of iron powder low hydrogen coating with the correct balance of alloying elements to produce 100,000 psi minimum tensile deposits with high ductily and notch toughness.

PROCEDURE: Tilt the electrode 5° to 15° in the direction of travel. Use a weaving or beading technique, clearing craters before restriking. Restrike electrode ahead of crater and move back to previous bead.

	As Welded	Stress Relieved	X-Ray Quality			
Yield Point psi	92,300	102,000	C	Mn	Si	P
Tensile Strength psi	93,500	103,000	0.06	1.12	0.70	0.013
% Elongation in 2"	23.0	22.0				
V-Notch Charpy ft. lbs. @ —65 F	46.0	41.0	S	Ni	Mo	V
Stress relieved at 1150 F for two hours, furnace cooled.			0.020	1.64	0.25	0.08

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

	diameter	3/32"	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"
	length	12"	14"	14"	14"	18"	18"	18"
amperes	flat	90-110	120-150	180-220	230-270	290-320	330-370	425-475
	vertical	70-90	110-140	140-170	160-180			
	overhead	80-100	120-140	140-170	170-190			
	volts	19-23	22-23	22-23	22-23	23-24	23-24	24-25

E 7010 A1

High-tensile, cellul tration. For carbon and creep resistanc

PROCEDURE: Horizon electrode tilted 5° motion, hesitating or weave motion. F

Yield Point psi -
Tensile Strength psi -
% Elongation in 2"

X-Ray Q

C	Mn	P
.09	.47	.015

RECOM

	diameter	1/8"
	length	14"
amperes	flat	110-130
	vertical	110-120
	overhead	110-130
	volts	26-27

CAST IRON

SW-Nickel ac—dc reverse

with a high-nickel core developed especially for achinable welds are required. The arc is excepractically no flutter or spatter. Arc length is uld be for mild steel. Fluidity of the deposited ashes" evenly up against the sides of the joint, ith low peneration and heat input. Slag is easily es thoroughly with the parent cast iron and will sed for welding cracked castings • building up ndersized areas • laying metal in faulty machine

in any position, including vertical and overhead. derate preheat of 150-250 F is desirable. When are severe, a preheat of 500-700 F is recommend- to retard the rate of cooling by covering work insulating material.

OMMENDED AMPERAGE RANGE:

	1/8"	5/32"	3/16"
	14"	14"	14"
	90-120	120-150	130-170

CAST IRON

ENi Fe SW-Nickel 55 ac—dc reverse

SW-Nickel "55" is a flux-coated special core wire which gives exceedingly strong ductile welds which prevent cracking and spalling out particularly applicable to high phosporous cast irons and ductile irons. It offers a stable arc in all positions, smooth bead contour, excellent "wash" and very easy slag removal.

PROCEDURE: Clean work of oil, grease and dirt. Grind off "skin." Use as low a welding current as is possible. Length of arc should be about the same as that used for mild steel electrodes. Flux should be removed from each crater before making restrike, and completely removed from each pass before starting subsequent pass. Use intermittent bead method to heat evenly. Peening moderately is useful in reducing streases. The finished weld should be cooled slowly. A blanket or other insulating material can be used. Preheating is recommended only when maximum machinability is required; when the heat developed by welding may cause cracking in other parts of the casting or when the weld must withstand pressure. A normal preheat is about 600 F.

RECOMMENDED AMPERAGE RANGE:

diameter	3/32"	1/8"	5/32"	3/16"
length	14" c.g.	14"	14"	14"
amperes	50-90	90-120	120-150	130-170

Throug

A

WELD

A. O. Smi

MW-230 9-58

TH ELECTRODES

MILD STEEL

6013 **MIL-6013** **SW-16** **ac—dc**

All position. Arc easy to handle with minimum of burn-through on thin gauges. Particularly adaptable for field applications on vertical down. Ideal on light gauges because of quick set-up and shallow penetration.

PROCEDURE: For flat welds — tilt 5° in direction of travel. Medium arc. Horizonal fillets — tilt 5° to 15° in direction of travel at angle bisecting vertical and base plate. For vertical down — tilt 30° in direction of travel. Hold short arc.

	As Welded	Stress Relieved
Yield Point psi	70,400	67,100
Tensile Strength psi	79,700	75,000
% Elongation in 2"	22.0	24.0

X-Ray Quality

C	Mn	P	S	Si
.10	.42	.020	.028	.35

Complies with:
Lloyds Register of Shipping
Navy MIL-E-15599

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	3/32"	1/8"	5/32"	3/16"	1/4"
length	12"	14"	14"	14"	18"
amperes flat	60-80	120-140	150-170	190-230	290-320
amperes vertical	60-80	110-140	140-170	175-195	
amperes overhead	60-80	110-140	145-170	175-195	
volts	19-22	21-23	24-27	24-27	27-29

MILD STEEL

E 6020 **MIL-6020** **SW-35** **ac—dc**

A mineral type electrode often referred to as a "hot rod" because of its high speed in downhand, horizontal or positioned fillets, flat work and deep groove welding where extreme ductility is required.

PROCEDURE: For flat welds — tilt 5° in direction of travel. Hold short arc. For horizontal fillets — tilt 5° to 15° in direction of travel, bisecting vertical and flat plate. Hold short arc, allowing the electrode coating to lightly touch the bottom plate.

	As Welded	Stress Relieved
Yield Point psi	56,600	48,900
Tensile Strength psi	63,900	59,800
% Elongation in 2"	29.0	35.5

X-Ray Quality

C	Mn	P	S	Si
.07	.32	.024	.027	.18

Complies with:
U. S. Navy — MIL-E 15599
A. B. S. — E 6020
U. S. Coast Guard
Lloyds Register of Shipping

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	7/32"	1/4"	5/16"
length	14"	14"	14"	18"	18"	18"
amperes	130-155	165-185	200-240	27-310	300-350	350-410
volts	27-29	27-29	28-30	29-31	30-32	32-34

LOW HYDROGEN

8016 C1 **SW-81** **ac—dc reverse**

2.0% nickel electrode with a low hydrogen type of coating that produces a smooth bead with an easily removed slag. Used extensively in fabrications of nickel-bearing steels that require both high-tensile and high-impact values at low temperatures.

PROCEDURE: Tilt electrode 5° to 15° in direction of travel. Hold short arc. Use weaving or beading technique. Important to clean crater before restriking. Restrike in center of crater and move back toward previous bead. Then reverse direction and continue.

	As Welded	Stress Relieved
Yield Point psi	73,200	75,900
Tensile Strength psi	82,400	85,100
% Elongation in 2"	24.5	29.5

X-Ray Quality

C	Mn	P	S	Si	Ni
.08	.64	.011	.024	.37	2.05

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"
length	14"	14"	14"
amperes flat	130-150	165-195	225-250
amperes vertical	120-130	145-165	
amperes overhead	120-130	145-165	
volts	22-24	23-25	24-26

LOW HYDROGEN

E 8016 B2 **MIL-52-16** **SW-90** **ac—dc reverse**

This low hydrogen electrode was developed specifically for welding 1.25% Cr-0.5% Mo steels used in high-pressure piping in power houses and similar installations.

PROCEDURE: Pre- and post-heat treat according to job specification. Tilt electrode 5° to 15° in direction of travel. Hold short arc. Use weaving or beading technique. Important to clean crater before restriking. Restrike in center of crater and move toward previous bead. Then reverse direction.

	Stress Relieved
Yield Point psi	80,600
Tensile Strength psi	91,900
% Elongation in 2"	24.5

X-Ray Quality

C	Mn	P	S	Si	Cr	Mo
.08	.63	.014	.030	.35	1.20	.54

Complies with:
U. S. N. — MIL-E-16589-52-16

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	1/4"
length	14"	14"	14"	18"
amperes flat	120-170	160-200	195-260	280-350
amperes vertical	90-120	110-140	140-170	
amperes overhead	100-130	130-160	170-200	
volts	23-24	24-25	25-26	26-28

LOW ALLOY — HIGH TENSILE

7010 A1 **SW-75** **dc reverse**

High-tensile, cellulosic coated electrode has cutting arc with deep penetration. For carbon-moly piping or castings where high tensile strength and creep resistance at high temperatures are desired.

PROCEDURE: Horizontal and downhand — hold medium to short arc with electrode tilted 5° to 15° in direction of travel. Weave with oscillating motion, hesitating at edges. Clean each bead. From bottom up, use whip or weave motion. From top down, use stringer bead or weave.

	As Welded	Stress Relieved
Yield Point psi	67,400	65,250
Tensile Strength psi	81,400	78,500
% Elongation in 2"	21.0	29.5

X-Ray Quality

C	Mn	P	S	Si	Mo
.09	.47	.015	.015	.20	.50

Complies with:
U. S. Navy — MIL-E-15716
A. B. S.
Lloyds Register of Shipping
U. S. Coast Guard

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	1/8"	5/32"	3/16"	1/4"
length	14"	14"	14"	18"
amperes flat	110-130	140-180	170-190	240-300
amperes vertical	110-120	130-180	150-190	
amperes overhead	110-130	140-150	160-170	
volts	26-27	27-28	28-29	29-32

LOW ALLOY — HIGH TENSILE

E 7020 A1 **MIL-7020 A1** **SW-76** **ac—dc**

This high-speed molybdenum-bearing electrode specifically designed for downhand or horizontal fillet welding on low-alloy, high-tensile steels. It is used where tensile strength of 70,000-80,000 psi after stress relieving is needed.

PROCEDURE: For flat welds — tilt 5° to 15° in direction of travel and hold medium to short arc. For horizontal fillets—tilt 5° to 15° in direction of travel, bisecting the vertical and base plate. Hold short arc.

	As Welded	Stress Relieved
Yield Point psi	66,100	69,900
Tensile Strength psi	75,900	79,400
% Elongation in 2"	25.5	28.5

X-Ray Quality

C	Mn	P	S	Si	Mo
.15	.47	.025	.025	.15	.57

Complies with:
A. B. S. — E 7020 A1
U. S. Coast Guard
Lloyds Register of Shipping
U. S. Navy — MIL-E-15716

RECOMMENDED AMPERAGE AND VOLTAGE RANGE:

diameter	3/16"	1/4"	5/16"
length	14"	18"	18"
amperes	200-300	280-340	380-420
volts	33-35	34-36	37-39

Through research ...*a better way*

A.O.Smith

CORPORATION

WELDING PRODUCTS DIVISION

Milwaukee 1, Wisconsin

A. O. Smith INTERNATIONAL S. A. Milwaukee 1, Wis., U. S. A.

MW-230 9-58

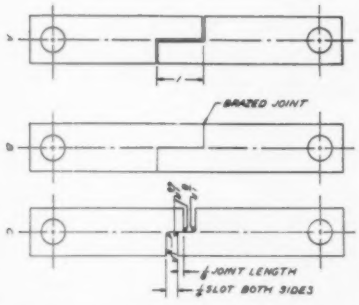
LITHO U. S. A.

7 out of 10 brazing experts want a standard shear test

Wall Colmonoy Corp. queried experts to see if procedures for testing shear strength of brazed joints should be standardized. 71% said yes.

DETROIT: In April, F. M. Miller and R. L. Peaslee of Wall Colmonoy Corp. proposed to the spring meeting of AWS that a standard specimen, a standard procedure and a standard evaluation for testing shear strength of brazed joints be adopted.

Following presentation of the paper, Wall Colmonoy sent copies to a select number of brazing authorities throughout the country, inviting their comments. Although few were willing to accept the Peaslee-Miller proposal without modification, most felt that the company was on the right track.



SINGLE LAP SPECIMEN for shear testing of brazed joints. A: Notched bars before brazing; B: After brazing; C: Slotted after brazing. Material is 1- by ⅛-inch strip.

Conclusions reached by Miller and Peasley based on the reported inquiry:

1. Shear strength data must be used with considerable caution in design engineering work.
2. Details for fabrication of test specimens should be included in the standard procedure.
3. The test specimen design proposed by Wall Colmonoy (see drawing) may require modification.
4. Reproducibility of results is a problem that will have to be a prime target for future investigations.

One of the most encouraging results of the proposal was the establishment of a special subcommittee of the Brazing and Soldering Committee of the American Welding Society. This committee will investigate shear test standardization. It is headed by Harry Schwartzbart, supervisor of welding research at Armour Research Foundation, a leading research organization in the brazing and welding field.

Lincoln Foundation Makes Bridge Awards

Farland C. Bundy and Charles S. Matlock, engineers with the Bridge Division, Texas Highway Department, Austin, Texas, received the $10,000 First Award in the recently judged $50,000 bridge design competition for welded bridges for interstate and defense highways, sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. They shared the award for the design of the recently completed Buffalo Bayou Bridge in Houston, Texas, a 668-foot all-welded continuous plate girder bridge.

Two Second Awards of $7,500 each were made. Co-designers Dale C. Hoffman and Dwight H. Sparks, Columbus, Ohio, received one for the design of a four-span 398-foot haunched girder bridge. A team of Turnpike engineers in Dallas, Texas, Joe C. Bridgefarmer, Douglas A. Nettleton and William L. Powell, received the other for the design of an all-welded arch bridge on the Dallas-Fort Worth Turnpike.

Three Third Awards of $5,000 each were shared by the three design teams.

more news on page 120

NOW
TUNGSTEN CARBIDE HARD FACING
with the METCO ThermoSpray Gun

Now you can apply coatings of this extremely hard material with the required concentration of carbide, to any desired thickness, with a low-cost installation in your own plant, or have it done at reasonable cost in a metallizing job shop.

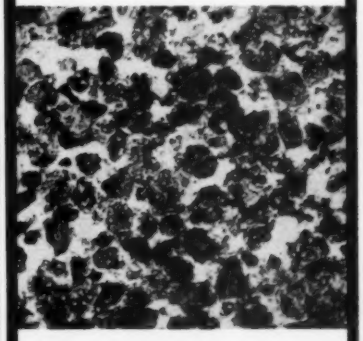


Photo-micrograph of sprayed coating, showing high tungsten carbide (dark particles) concentration. Mag. 50x – actual size of area shown, approx. .040" x .040". (Photo courtesy Sam Tour & Co., Inc.)

These coatings are non-porous, homogeneous, have very high tensile strength and provide excellent wear resistance under the most extreme service conditions.

For full details—write, wire or phone for Bulletin 139. No obligation, of course.

METCO

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, Long Island, New York EDgewood 4-1300
In Great Britain: Metallizing Equipment Co., Ltd., Chobham near Woking, England

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☑ Check these Facts

B est buy in welding accessories because of **HI-AMP'S** low maintenance cost with interchangeable insulation between models.

U sed on the heaviest welding jobs with complete satisfaction because of **HI-AMP'S** cool running and ease of handling.

Y ellow Glass Fibre handle distinguishes **HI-AMP** from other dark colored objects, providing additional safety feature

H eavy welding jobs handled with ease because of excellent design of **HI-AMP** to take high amperage and high duty cycles.

I ncreased life of insulation because of the ability of **HI-AMP** insulators to withstand higher temperatures than other types of insulation.

A **HI-AMP** to fit every manual arc welding requirement, from the smallest rod to the heavy iron coated electrodes.

M ake a point of insisting on **HI-AMP** products to do the welding job for you.

P lan now to completely equip your shop with electrode ® holders and ground clamps by **HI-AMP.**

Ask your welding supply dealer or write for additional information.

LENCO, Inc. JACKSON, MO.

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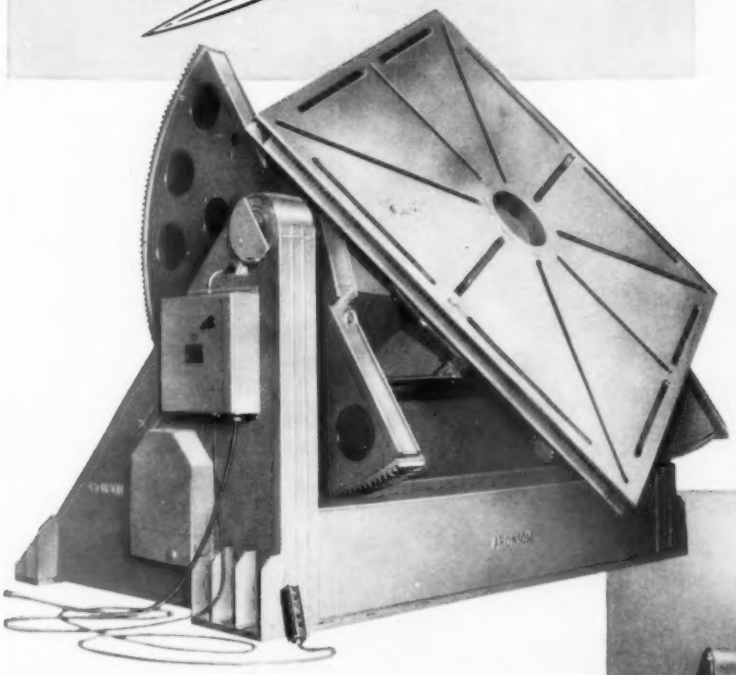
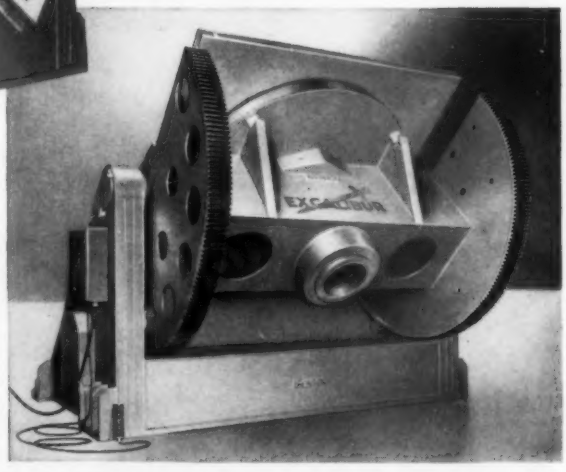
EXCALIBUR..... the HIGHEST LOAD CAPACITY Welding Positioner EVER BUILT



Aronson
MODEL G 3500



"EXCALIBUR" is rated 350,000 pounds Load Capacity with CG 12" above table and 6" off-center.

FOUR SELECTIVE VARIABLE SPEED RANGES obtained from the 4-speed gearshift transmission driven by 15 hp Varidrive afford far greater choice of variable rotation speeds. In High Gear top speed is .4 rpm adjustable to .07 rpm. This exceptionally high rotation speed permits automatic welding at high travel rate on diameters as small as eight inches! Then, for larger diameters shift into 3rd Gear and use the .23 rpm to .04 rpm range. Or, still larger work may require 2nd Gear's .13 rpm to .023 rpm range. Largest weldments are profitably rotated in Low Gear range's .08 rpm to .013 rpm.

"EXCALIBUR" is not physically tremendous, being only 88" from floor to horizontal rotation axis, which allows working both large and small weldments without needing excessive headroom and without working too high above the floor.

"EXCALIBUR" has been designed to handle almost every kind of weldment at lowest possible shop cost.

Owning "EXCALIBUR" opens production doors to you that are closed to your competitors. It is NOT a special job machine, but a Welding Positioner that will handle 90% of your jobs that are as small as a ton or so to as large as 175 tons!

Owning **"EXCALIBUR"** lets you weld automatically those jobs you now wrestle around the shop floor with the profit-eating crane and have to weld manually.

With **"EXCALIBUR"** in your list of machine tool facilities you not only can underbid competition but can assure the award of the contract because your customer will know you have the facility to handle his work.

Quality POSITIONERS by **Aronson MACHINE COMPANY**
ARCADE, NEW YORK

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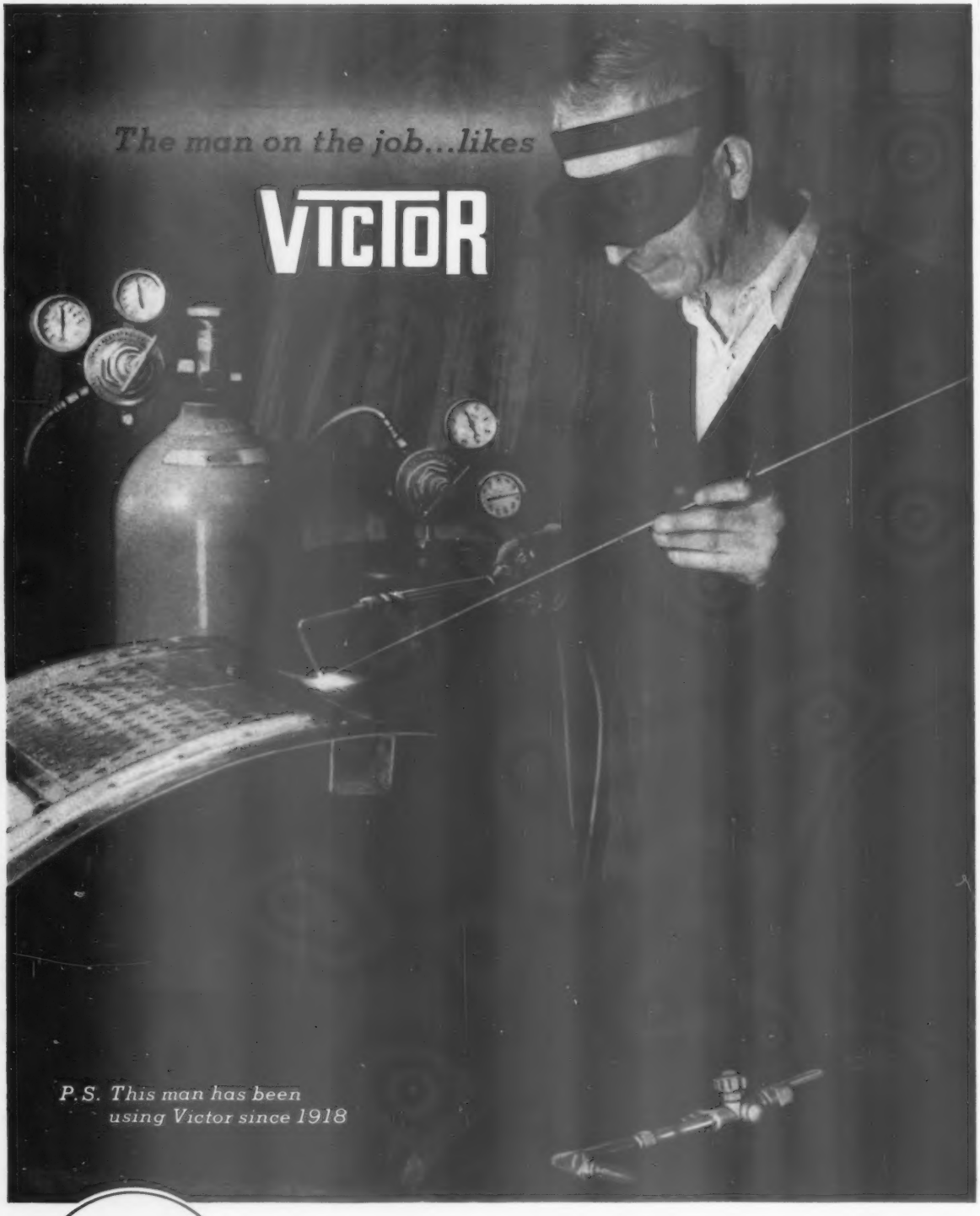

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VICTOR for welding

VICTOR EQUIPMENT COMPANY

Mfrs. of welding & cutting equipment; High Pressure and Large Volume Gas Regulators; hard-facing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

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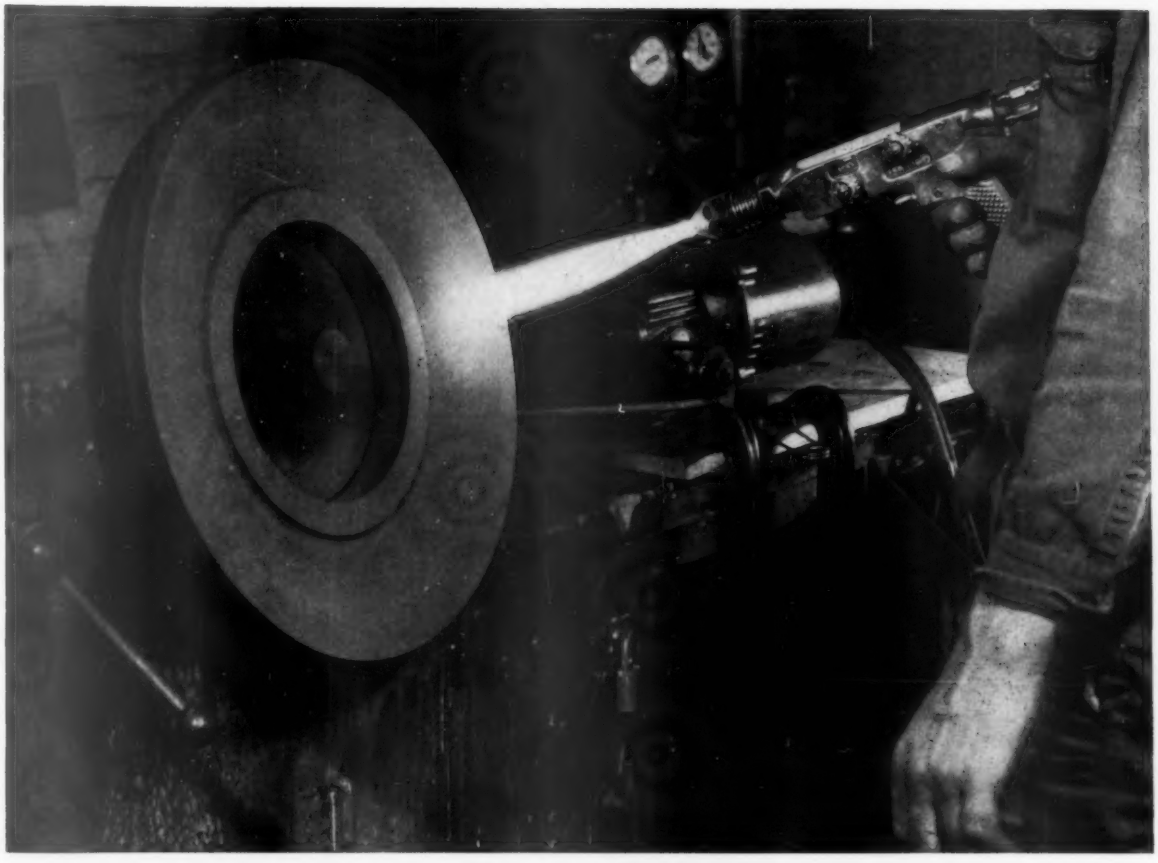

NEW! KENSPRAY*

More abrasion/corrosion resistant than any hard surfacing powder you've ever used

First introduced at the A.S.T.E. Show this year, Kenspray, a tungsten carbide spray powder, produces a hard surface overlay tightly bonded to the base metal. Kenspray may be applied to almost any contour, with the resulting surface having extremely high resistance to heat, galling, abrasion, corrosion and impact.

Using standard metal spraying techniques and equipment, Kenspray gives you the most abrasion/corrosion resistant surface ever, plus—faster application using less spray powder, and a smoother, more uniform, longer lasting surface.

Kenspray is now available in two grades, suitable for use with most all types of standard guns. Overlays may be applied in thicknesses from .010″ to .090″ for fusing at 1950°F . . . can be applied to majority of base metals with melting points above 2000°F. In minimum time, fine finishes may be accomplished with either a silicon carbide or diamond grinding wheel.

Get the full story. Call your Kennametal Carbide Engineer or send for Special Products Bulletins L-5 and L-6. Write KENNAMETAL INC., Dept. IW, Latrobe, Pa. 3188

*Trademark

INDUSTRY AND **KENNAMETAL** *. . . Partners in Progress*

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Insert halves are first carefully cleaned and fluxed. The sheet of EASY-FLO, .005" thick, in three sections, is liberally fluxed with HANDY FLUX. Following this, the halves are put together with EASY-FLO as a "sandwich filler" (below, left). Entire assembly is heated to a brazing temperature of 1170° F.

How EASY FLO Helps COLUMBIA RECORDS make records

EASY-FLO is put to excellent use in the die inserts (or backing plates) used in the manufacture of Columbia Records at the company's Bridgeport, Connecticut, plant. These die inserts are the heating and cooling elements used in the actual plastic record molding; in a very real sense, they are *behind* the entire record-making operation. The die insert assembly consists of two steel plates, the bottom plate being grooved to permit the passage of steam, at a temperature of 300° F under a pressure of 130 lb., followed by cold water at a pressure of 120 lb. When joined, they must be absolutely leak-tight and strong enough to stand up under thousands and thousands of stampings through drastic temperature changes and thermal shock.

These brazed backing plates have a life cycle of some 250,000 records; they are usually retired because of warpage in the steel, rarely for joint leakage.

This example illustrates just a few of the qualities that make silver brazing such a superior joining method. Strength under high pressure, resistance to temperature changes and thermal shock, and production ease; one, or all, of these qualities may apply to your product or production operation. We will be happy indeed to show you how you can benefit from this blue-ribbon method of joining all kinds, shapes and sizes of metals—similar and dissimilar. BULLETIN No. 20 will get you off to a good start on the values, techniques and economies of low-temperature silver brazing. Write for your copy.

Your NO. 1 Source of Supply and Authority on Silver Brazing Alloys

HANDY & HARMAN

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DISTRIBUTORS IN PRINCIPAL CITIES

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. . . . Lifts you right up where you can work efficiently with complete safety

Talk about saving man-hours—this Economy self-propelled lifter can be moved about the floor, and up and down to any level with push-button control on the platform. It's like an extension of your own legs for speeding the job. Imagine the comparative cost of a two-man ladder or stationary platform that requires climbing up and down to move with each shift in the work. A man feels perfectly safe on this portable lifter and can devote full attention to the work.

For over 50 years Economy has specialized in engineering and building lifters and material handling machines designed for special jobs.

Put your problem in the hands of our engineering representatives. located in all principal cities, who will be glad to talk over your requirements and make recommendations and estimates without obligation.

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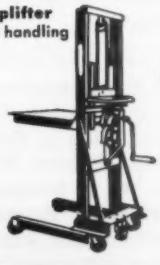
ECONOMY ENGINEERING

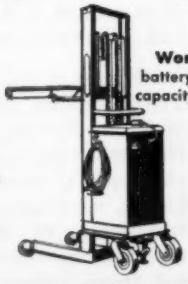
Economy makes a complete line of standard lifters

Barrel Racks

Elevating table

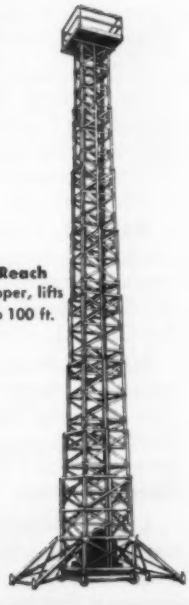


Shoplifter for die handling



Worklifter battery powered capacity 1000 lbs.

Model PUL overhead service lifter



Hi-Reach telescoper, lifts up to 100 ft.

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MEN ON THE MOVE

in the welding industry

Hinkel

Mellini

Stringham

Stacy

Neil

Lawson

APPOINTMENTS:

INDUSTRY & WELDING has made two changes in its sales and editorial staffs. **Herb Hinkel,** former associate editor, has moved to New York City where he will handle Eastern advertising sales. He had been in charge of Cleveland District Sales for *General Electric Co.* before joining I&W. New associate editor is **Anthony Mellini,** formerly manager of technical services, Metal Products Div., *Goodyear Tire & Rubber Co.*, Akron, Ohio.

L. K. Stringham has been elected vice president, research and development, of the *Emerson Electric Mfg. Company* of St. Louis. He was formerly vice president in charge of engineering for *Lincoln Electric Company,* Cleveland, Ohio. Announcement was made by W. R. Persons, Emerson president.

L. D. Rounds, vice president at *Hammer Blow Tool Co.*, Wausau, Wisconsin, announces the appointment of **Jack W. Stacy** as chief engineer for product development and improvement.

Hollis B. Cranmer has joined the Metals division of *Olin Mathieson Chemical Corp.* as manager of aluminum distributor sales for Olin Aluminum.

John H. Hartleb has been appointed a field engineer at the Los Angeles District Office of *Norton Company.* New field engineer in the Cleveland office is **Harold F. Platt.**

L. G. Matthews has been named Secretary of the *International Acetylene Association.* He succeeds the late **H. F. Reinhard** with whom he had worked for eight years. Mr. Matthews has been with Union Carbide for 23 years.

Troy G. Cox has been named to manage the *Harris Calorific Company* branch in Dallas, Texas. Appointment was made by **C. M. Taylor,** Harris' president.

Two new additions to the executive staff at *Progressive Welder Sales Co.*, Pontiac, Mich., are **William T. Wilbur,** chief engineer, and **Stephen E. Jerome,** factory manager.

Joseph T. Kohn, Jr., is the new factory superintendent at *Safety Clothing & Equipment Co.*, Cleveland, Ohio.

A. E. Carter has been named Vice President of Manufacturing at *Worthington Corp.*, Harrison, N.J.

ELECTIONS:

New officers of the *Independent Welding Distributors Association* (Western United States, Alaska and Hawaii) are **Willis Stanfill,** Welders Supply Co., Portland, Oreg., president; **Ted Cox,** Ted Cox Welding Supplies, San Bernardino, Cal., vice president, and **M. J. Andrews,** Salinas, Cal., secretary-treasurer.

Officers of the new Nashville, Tenn., section of the American Welding Society are **Burton C. Haworth,** chairman; **John L. Bevill,** vice chairman; **Robert W. Liddle,** secretary; **W. E. Moran,** treasurer; **W. Michael Belew,** membership chairman, and **Russell Staub,** program chairman.

Pollock

Richardson

PROMOTIONS:

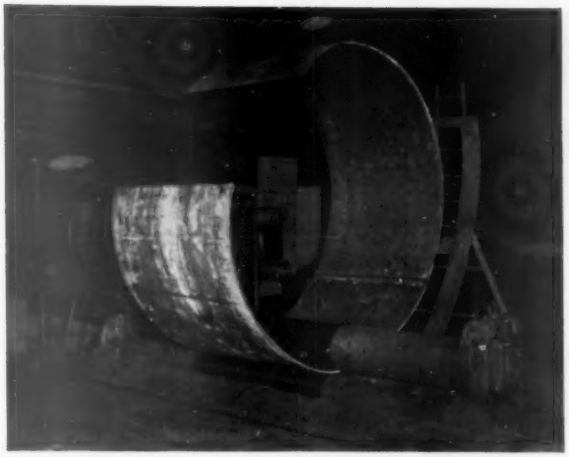
Three promotions have been announced by *National Cylinder Gas Division of Chemetron Corp.* Named were **Hayes W. Neil,** Rocky Mountain regional manager; **Edwin L. Lawson,** Denver district manager, and **Herbert H. Pollock, Jr.,** Pueblo district manager.

Derek Richardson has been appointed vice president of aluminum sales, Metals division, *Olin Mathieson Chemical Corp.* He had been sales manager of the Corporation's Industrial Chemicals Division.

James A. Perham, chief product engineer of the *Thor Power Tool Company's* Aurora (Ill.) Works, has been named chief engineer of Thor's SpeedWay Mfg. Co. division at LaGrange Park, Ill.

Crucible Steel Company of America has announced two appointments in the Technical Development division of its Technology Department. **A. E. Nehrenberg** has been named Section Manager — Technical Development; **R. W. Metter** was named Administrator — Patents and Licenses.

Tanks, heat exchangers and processing equipment for tough jobs are fabricated quickly and easily of corrosion-resistant Everdur®



At Old Dominion Iron and Steel Corporation, Belle Isle, Richmond, Virginia, *(O.D.I.S.), fabricators of tanks, heat exchange equipment and pressure vessels,* two plates of Everdur-1010 (151¾ x 56$^{3}/_{16}$″ x .513″), previously welded together, are rolled to form a cylindrical tank section.

When rolling is completed the beveled edges of the plates are butted to form a vee groove which then will be welded to complete the section. Five such sections will be put together by *Old Dominion Iron & Steel Corporation* to make the 26′-9″ shell of the storage heater.

The storage heater is completed by attachment of two flanged and dished heads 96″ outside diameter. The heads were press-formed and spun by *Old Dominion Iron and Steel Corporation* from circles of Everdur-1010, 104″ in diameter and .674″ thick.

The completed 10,000-gallon storage heater has 196 feet of welds. All welding was done with the inert-gas tungsten-arc using Everdur-1010 Welding Rod, which makes welds that meet ASME Boiler and Pressure Vessel Code requirements for soundness, strength, ductility.

EVERDUR-1010 provides the high strength and excellent corrosion resistance needed for all kinds of hot-water storage tanks and for pressure vessels and equipment used in the chemical and processing industries. This tank will be used for hot-water storage in a wool-dyeing plant.

High-strength, corrosion-resistant alloys, basically copper and silicon, are made and sold by The American Brass Company under its trade-mark, Everdur. They were developed for structural and engineering uses which require metals of high tensile strength combined with immunity to rusting, and corrosion resistance equivalent to that of copper. Everdur alloys are nonmagnetic, highly resistant to fatigue, and, depending on the alloy, suited to hot or cold working and economical fabrication by welding. 58107

EVERDUR®

COPPER-SILICON ALLOYS

Products of

ANACONDA®

Made by The American Brass Company

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How Claude Phillips helped

More than ten years experience as a welding specialist gave Claude Phillips a sound basic knowledge of metallurgy and grinding methods. In the years since World War II, he has expanded that knowledge into an expert's familiarity with all types of grinding techniques. It is this wide yet concentrated experience that makes him so outstandingly useful to his customers.

Circle No. 25 on Reader Service Card.

cut stainless steel weld-grinding costs

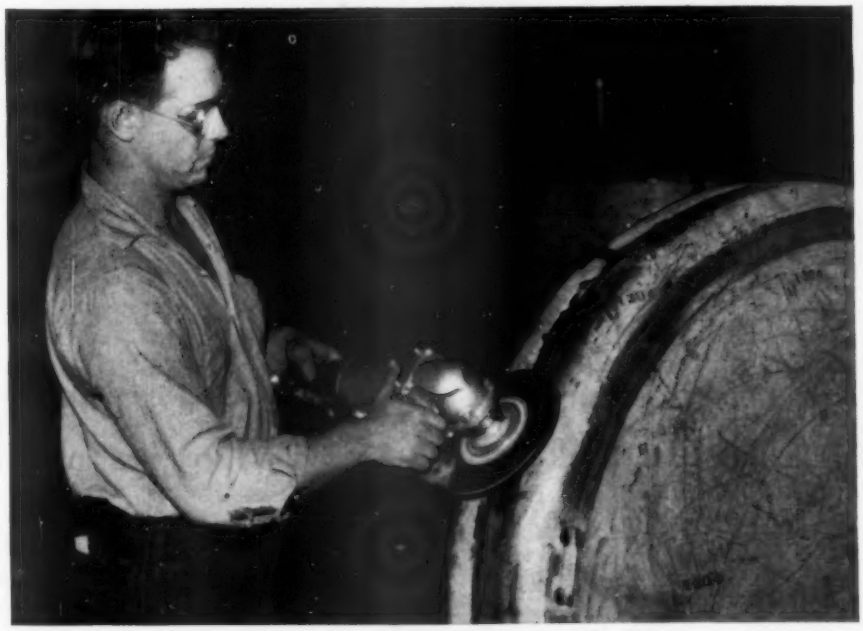
There's nothing delicate about stainless steel until you overheat it. Then you've got a problem... because excessive heat breaks down the chemical structure of the metal and reduces its resistance to corrosion.

Nobody is more conscious of this than Plant Manager John Luker of Gaston County Dyeing Machine Co., Stanley, N. C., and the man who helped him solve the problem... Claude Phillips of Bay State distributor Southern Oxygen Company.

Knowing the job that Bay State Blue Flash R grade wheels had been doing for others, Phillips persuaded Luker and Purchasing Agent James Stroup to try them. They not only cut cool... comfortably below the 670°F critical limit of stainless... they gave him a higher rate of stock removal than any other wheel on the market. As a result, more work is produced per payroll dollar and there are neither hot spots nor weak spots in Gaston County Dyeing machines.

Like Claude Phillips, your own Bay State distributor is an experienced specialist in grinding problems. Cost-cutting ideas he develops for others may be unexpectedly useful to you, too. Why not get in touch with him and see what he can do? *Better grinding at lower cost—that is his business.*

Operator uses 9" x 1/8" Blue Flash R grade raised hub disc wheel to blend pressure tank of T-316 stainless. This wheel generates minimum heat yet gives extremely high rate of stock removal.



BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

Circle No. 25 on Reader Service Card.

Prevent wear beyond repair

with new *Ranite* Check Chart System

The wear of construction equipment parts is one of the highest cost factors of contractor operations. Only careful inspection and regular systemized maintenance can hold this cost down.

To promote regular inspection of equipment parts, Ranite offers at no cost or obligation their new Ran-Check-Charts and Stickers for systemized preventive maintenance. They provide an easy way for periodic checking of all non-lubed part surfaces so as to prevent "wear beyond repair" conditions.

For maximum wear-life Ranite's seven types of Job-Graded, Color-Coded hardsurfacing rods have been formulated to meet all wear conditions whether caused by abrasion, impact or a combination of both forces. Smooth running, all position, rapid deposition Ranite rods cover more area per pound making it most economical to use.

RANKIN MANUFACTURING CO.
616 S. Marengo Ave.,
P. O. Box 631, Alhambra, Calif.

Get your free Ran-Check-Charts and Stickers from your local Ranite distributor or write direct today.

Ranite
HARDSURFACING RODS

Circle No. 83 on Reader Service Card.

Individual flame testing of each cutting tip is just part of Smith's quality control. These patented tips have mirror-smooth gas passages, recessed flexible seats for protection against damage.

BONUS: the World's Best Repair Service when you use Smith's equipment!

The steady, dependable use you get from your Smith's equipment means you seldom have any down-time. But when you do, you can measure it in minutes, thanks to the World's Best Repair Service! The quality—and quality controls—we put behind our products means a frequency-of-repair rate so low that we can afford to offer this remarkable service.

Here's how it works: if a piece of your Smith's equipment becomes inoperative, you exchange it for a 100% factory reconditioned piece of the same equipment . . . completely overhauled, with new seats, packing, seal rings, and newly refinished in bright nickel. No matter what the damage to your equipment, your only cost is a low flat-rate repair charge. *And there's no waiting:* you make on-the-spot exchange at your Smith's distributor. Just bring in your damaged equipment, pick up a like-NEW replacement!

For more information about the World's Best Repair Service, covering all major items currently manufactured, *write:*

SMITH'S®

Smith Welding Equipment Corporation
2621 Fourth Street S.E. **Minneapolis 14, Minnesota**

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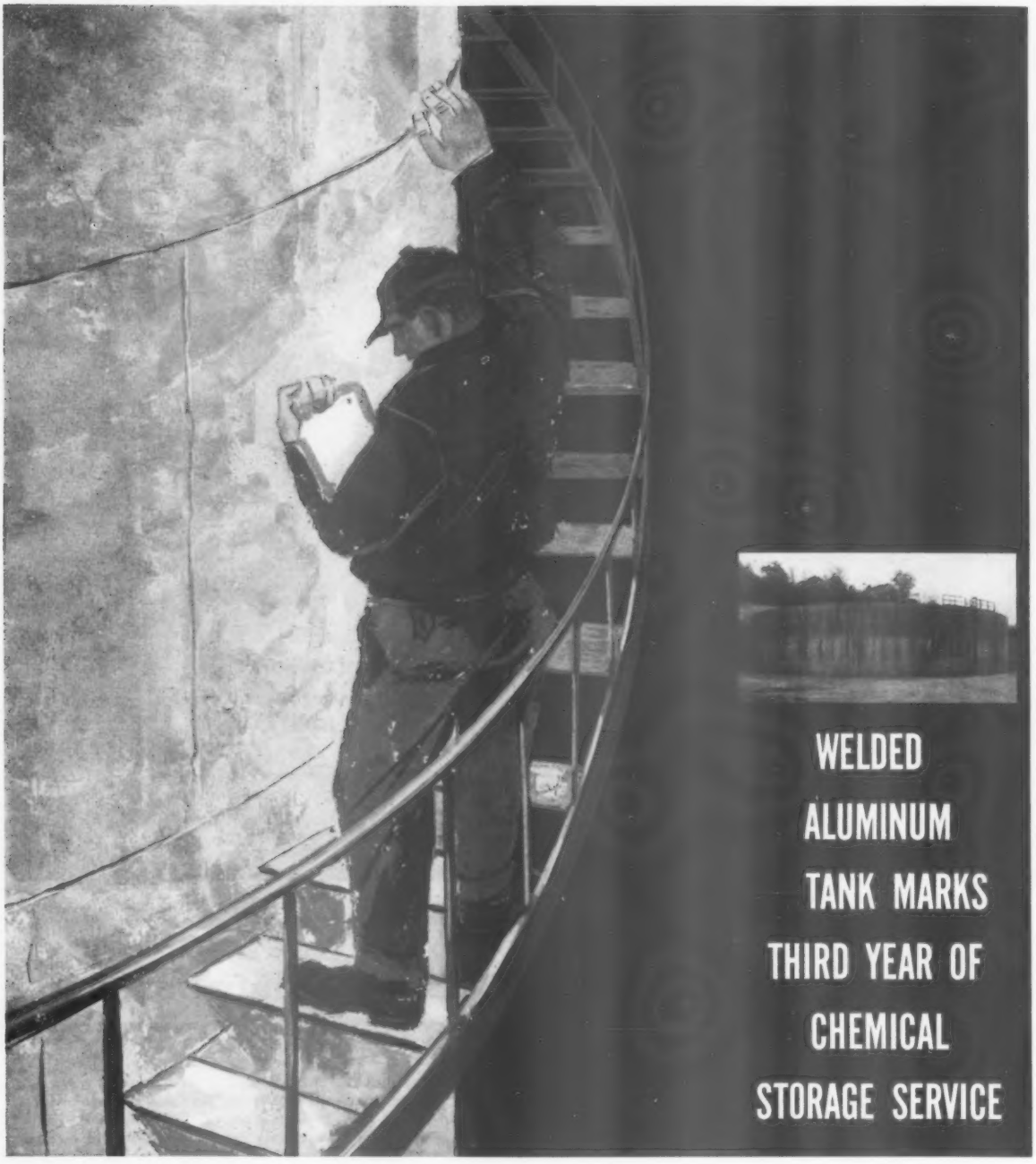

WELDED ALUMINUM TANK MARKS THIRD YEAR OF CHEMICAL STORAGE SERVICE

Mississippi River Chemical Company's all-aluminum welded tank is doing the job expected when it was built three years ago—providing trouble-free chemical storage with a minimum of maintenance.

The world's largest welded aluminum tank, it stretches 128 feet in width and rises 26 feet in height. After more than three years of constant exposure to 2½ million gallons of highly corrosive ammonium nitrate, its Alcoa® Aluminum plates and weldments remain virtually unaffected, ready for longer service.

The giant tank was field erected by the Chicago Bridge and Iron Company. Welds were made with Alcoa welding alloy 5052 by the inert-gas, metal arc-welding process. The bottom plates are 1⅞ inches thick and courses taper to ⅜ inch at the top.

Alcoa, besides supplying the aluminum for this gigantic undertaking, rendered valuable help and guidance before and during construction. You can get the same help in welding, brazing or soldering aluminum by calling one of the Alcoa Distributors listed here. For FREE informative books and for free loan of films on joining aluminum, write: Aluminum Company of America, 1742-K Alcoa Building, Pittsburgh 19, Pa.

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Fine Entertainment
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Your Guide to the Best in Aluminum Value

Want technical help in welding, brazing or soldering aluminum? Contact your Alcoa sales office, listed under "Aluminum" in the Yellow Pages of your phone book.

For immediate delivery of Alcoa welding products, call your Alcoa outlet listed below. He carries a complete range of alloys and sizes.

ALABAMA
Birmingham
Hinkle Supply Co.

CALIFORNIA
Los Angeles
Ducommun Metals & Supply Co.
Pacific Metals Company, Ltd.
San Francisco
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COLORADO
Denver
Metal Goods Corp.

CONNECTICUT
Milford
Edgcomb Steel of New England, Inc.
Windsor
Whitehead Metal Products Co., Inc.

FLORIDA
Jacksonville
The J. M. Tull Metal & Supply Co., Inc.
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Tampa
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GEORGIA
Atlanta
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Southern Oxygen Co.

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Chicago
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KANSAS
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Circle No. 6 on Reader Service Card.

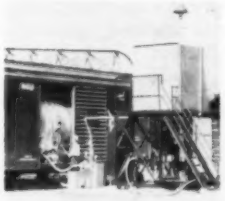
WELDING MANAGEMENT

watches these developments

WELDED ALUMINUM BRIDGES are getting a big play these days. The Iowa State Highway Commission is puting up the world's first all-welded aluminum girder-type highway bridge with the help of the nation's three major aluminum producers: Aluminum Company of America, Kaiser Aluminum & Chemical Corp. and Reynolds Metals. (see details on page 60). At Fort Belvoir, Virginia, Army engineers are conducting experiments on four full-size all-welded aluminum truss panels for a military tactical bridge. (see details on page 24).

TECHNIQUES FOR BRAZING aluminum to stainless steel have been developed by the South Wind Division of Stewart-Warner Corp. According to the company the *Alcres* process makes it possible to combine in a composite structure the light weight and high heat transfer characteristics of aluminum with the higher strength and superior fatigue characteristics of stainless.

A RAILROAD TANK-IN-BOX CAR for transporting liquid oxygen, nitrogen and argon has been introduced by Linde Company, Division of Union Carbide Corp. Car has an oxygen capacity of the liquid equivalent of 1 million cubic feet NTP. Linde offers a license package including working drawings, use of patents and necessary engineering assistance.

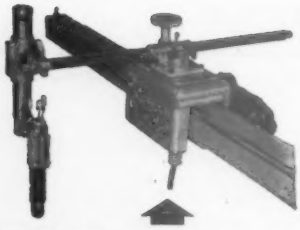


A GROUP INSURANCE PLAN for National Welding Supply Association members and their personnel has been developed in cooperation with The Travelers Insurance Company, Hartford, and the Girard Trust Corn Exchange Bank of Philadelphia. N.W.S.A. headquarters announced the plan in a brochure mailed to members. It protects against accidental death and dismemberment and is also a group life policy.

FOR THE MISSILE AGE, A MISSILE STEEL with a combined strength and ease of fabrication never before achieved. John M. Hodge, U. S. Steel metallurgical engineer, holds tests samples of a new ultra-high-strength alloy sheet steel, just tested and evaluated under the laboratory identification of Airsteel X-200. It is air hardenable and after tempering develops tensile strength levels in the 280,000 psi range without elaborate oil or salt quenching. Weldability studies showed welded joints in the steel are equal to the ultra-high-strength level of Airsteel itself. Production methods of welding evaluated during the study included metallic arc and inert arc processes.

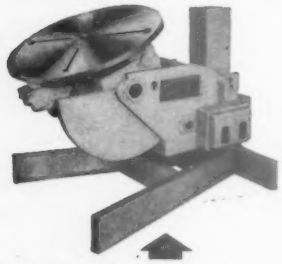
FACTS AT YOUR FINGERTIPS: Just circle the appropriate number on the Reader Service Card to get information on any of the products featured in this issue.

WELDING COSTS TOO HIGH?

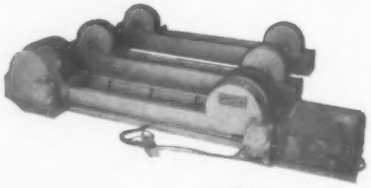


SEAMERS — A portable carriage, for welding, scarfing, cutting, and gouging.

Look to Cayuga *for the best in*



POSITIONERS—100 lb. and larger capacities. 135° tilt, vertical adjustment, rheostat remote control, ground current collectors.

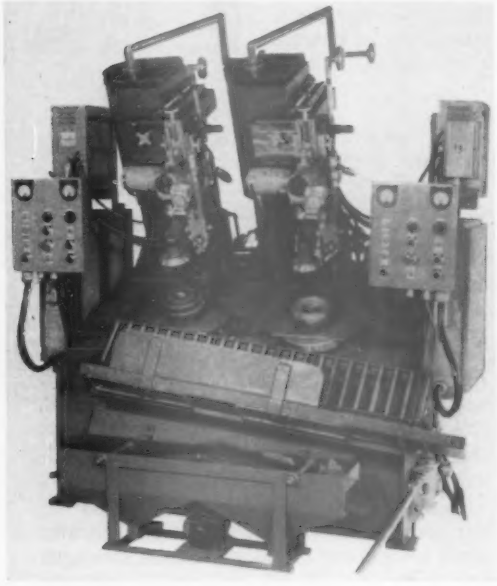


TURNING ROLLS—2500 lb. and larger, 6" to 13' diameter tank range. Rheostat remote speed control.

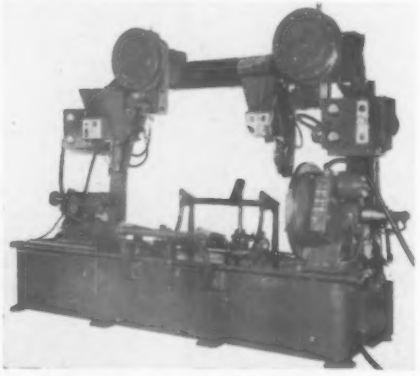
WELDING HEAD MANIPULATORS

3' x 3' to 25' x 25', 360° rotation. Manual or powered vertical travel, and manual or powered variable speed ram travel, rapid traverse. Safety devices prevent ram falling accidentally. Rheostat remote pendant control.

Custom-High Production Manufacturing Units



WHEEL DRUM WELDER—2 spindle—one operator —automatic unloading. Welds drum to hub sections. Production rate—600 per hour. Submerged arc or CO_2 process.



GIRTH WELDER component of a Cayuga automated tank welding assembly line. Production rate —one per minute for light tanks.
Other Cayuga units include Sheet Splicer, Head Press, Flue Press and Flue Swedge.

EXCLUSIVE
CAYUGA-TRON DRIVE

Designed especially for precision control of automation machinery.
Speed Range—Up to 50 to 1.
Precise regulation.
Load Change—Overhauling to 100% overload.
Constant Torque—Remote Control.
Ratings up to 1 HP.

CAYUGA MACHINE and FABRICATING CO., INC.

DEPEW - BUFFALO, NEW YORK

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For only $99 — you're "in business" with this PUROX W-200 Starter Set

You get all this standard, professional equipment:

- Welding Blowpipe
- Welding Head (welds up to ⅛")*
- Cutting Attachment (90° head)
- Cutting Nozzle (cuts up to 2")
- PREST-O-LITE Oxygen Regulator
- PREST-O-LITE Acetylene Regulator
- 12½-ft. Fitted Double Hose Assembly
- OXWELD Goggles with "A-A" Lenses
- OXWELD Friction Lighter
- Blowpipe Wrench
- Regulator Wrench
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- Enameled *Steel* Carrying Case for everything

and—for a limited time only, at no extra cost—

How-To-Do-It Reference Library of 17 instructive booklets (total list price, $3.35). (Offer good during October, November, and December, 1958 only.)

*9 additional head sizes available, as required, for welding all metal thicknesses up to ½ inch

COMPLETE $99.00

This is a LINDE-built, high-quality welding and cutting outfit, designed for rugged service. All standard industrial equipment for maximum flexibility and portability.

Available now from your local supplier of LINDE products. If you don't know him already, write for his name and address. LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited, Toronto.

Linde TRADE-MARK

UNION CARBIDE

"Linde," "Oxweld," "Purox," "Prest-O-Lite," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

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SMS CORPORATION

HEADQUARTERS
FOR

RESISTANCE WELDING SUPPLIES

R. W. M. A. CLASSES OF ALLOYS
IN CASTINGS, FORGINGS AND BAR STOCK &
COPPER TUNGSTEN ALLOYS

WELDER WHEELS IN ALL ALLOYS
AND SIZES TO SUIT YOUR REQUIREMENTS

ALL TYPES OF STRAIGHT AND OFFSET HOLDERS
STANDARD ELECTRODES

AND SPECIAL TO YOUR SPECIFICATIONS

ADJUST-A-PRESSURE HOLDERS

ADJUST-A-ANGLE ADAPTERS
FOR MULTIPLE SPOT AND INDIRECT SPOT WELDING

TIP DRESSERS, REAMERS AND CONTOUR DRESSERS

WE DESIGN AND BUILD SPECIAL ELECTRODES
AND FIXTURES

S-M-S CORPORATION

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IMPORTANT ANNOUNCEMENT To Users of Cutting Machines

These widely-renowned oxygen cutting machines feature a distinctive construction and an engineered system of operation. With them, you can now achieve new standards of accuracy in precision workmanship. Write for full details!

NEW SALES MANAGER NAMED

Richard L. Deily has been appointed Sales Manager for Messer Cutting Machines. He is a graduate of Lehigh University. His 20 years' experience in the cutting machine and welding fields includes positions with some of the largest firms in the metal-working industry. May he consult with you on improved cutting techniques?

AMERICAN MESSER CORPORATION WILL NOW HANDLE AND SERVICE THE WORLD-FAMED

MESSER CUTTING MACHINES

"THERE IS NO SUBSTITUTE FOR MESSER EXPERIENCE"

AMERICAN MESSER CORPORATION

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PRECISION CUTTING MACHINES...OXYGEN, NITROGEN, ARGON PLANTS

Messer

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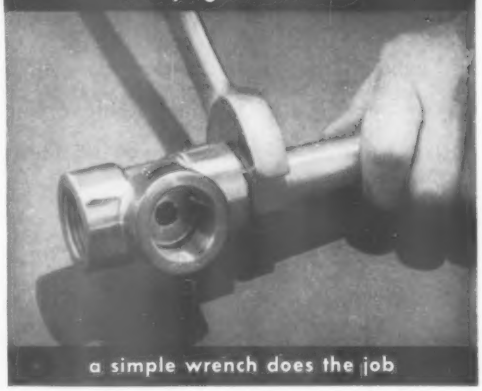
compound Pressure*

the new and better cylinder manifold...



The new compound pressure* cylinder manifold is made of the sturdiest die forgings and extruded rods; all are drilled for uniform inner dimension. The leak proof joint which results from the compound pressure design is tighter and more leakproof even than the well understood and long used connection between regulator and cylinder valve. The big improvement of this new invention lies in these facts: you can have any competent mechanic assemble a cylinder manifold to your own or our specifications with the assurance of absolute alignment and permanent leak proofness. Yet, the resulting cylinder manifold may be disassembled at any time, stored or moved and reassembled when required. It may be extended when needed, redesigned when desired, stored in bins as individual fittings. Only the bushings move in assembly, thus absolute alignment is certain.

*patents applied for

by

National SINCE 1910 of ...california

NATIONAL welding equipment company... 218 fremont street san francisco 5 california

535

Circle No. 78 on Reader Service Card.

Goldie and welding...

to the hills men!

I love my wife Goldie . . . but understand her? Never.

Take the time I was away for a week of fishing. A couple of days before I left, Goldie overheard me talking to a weldor about a low-cost hard surfacing rod coming out called Inco-Hard* #1 Electrode.

While I was away, Charlie Grant — an old buddy of mine—called me about a dredge cutter that needed surfacing with a tough and extra hard coating. Goldie . . . and why she did, I'll never know . . . tried to fill him in on the details about this new product.

It went something like this . . .

Charlie asked, "Goldie, how hard a surface did Nick say this new #1 Electrode put on cast iron and low alloy steels?"

"I remember Nick saying something about 700 Brindles . . ." said Goldie.

"Brindles?" laughed Charlie, "you mean Brinell?"

"That's the word, Charlie...Brinell," she said.

"Nick said 700 with two layers and I think 5. . . . Yes, 500 with one." Then she threw the monkey wrench. ". . . Or was it 700 with one and 500 with two?" she asked.

"Well," Charlie teased, "it doesn't matter, Goldie, the difference is only 200 either way!"

"Oh you! . . . You better call back when Nick gets home," my wife Goldie said sharply.

"Wait, Goldie . . . I'm sorry . . . don't hang up! . . . It's important. Can you remember anything else Nick said?"

She thought for a while. He sounded sincere. She then said, "Yes, I remember him saying something about jelly. Charlie, does that mean anything to you."

"Jelly. No . . . but wait a minute. Currant jelly . . . could he've said something about current?"

"Current . . . that's it . . . now it all comes back to me . . . Nick said something about setting the oven . . . no, not the oven . . . the range, that's it, the range . . . set it lower when you use the thing out of position. And I distinctly remember Nick saying that it can be used on Acey or Ducey," she said in one long breath.

"Acey, Ducey? Goldie, are you giving *me* a quick shuffle?"

Well, that's the way it went. But in spite of Goldie, or maybe because of her, Charlie did a fine job on those dredge cutters.

Why don't you send for technical literature on Inco-Hard #1 Electrode! The fishing season is here and I'm sure you wouldn't want to go through a mix-up like that. Write me in care of Inco and I'll send the material along to you.

Yours for better welds,

Nick Rodder

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

*Trademark of International Nickel Company, Inc.

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Visit the METAL SHOW

CLEVELAND PUBLIC HALL

October 27-31

You can do it better with metals . . . for less, if you are up-to-the-minute on your metals know-how and know-why. Competition calls for the most efficient use of metals, equipment, processes . . . for correct design applications.

You can meet this challenge by attending the Cleveland Metal Show and Congress. You will see hundreds of operating production-saving displays. Metals, fabrication techniques, processing methods, testing and inspection — all these and more will be assembled in the vast Public Hall for your convenient inspection.

You will want to hear the scores of technical and practical sessions that ASM and the cooperating groups will present, featuring experts on new achievements in metals. In short, this is *your* event of the year in metals . . . you will use the ideas you pick up at the Metal Show all year long to save time and money for you and your firm.

Exhibitors: excellent space locations in this great "Metals Will Make It Better . . . for Less" Metal Show are available now — write or wire for details.

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Cooperating Activities: Institute of Metals Division . . . Iron and Steel Division . . . Extractive Metallurgy Division of the American Institute of Mining, Metallurgical and Petroleum Engineers . . . Society for Nondestructive Testing, Inc. Associations presenting technical sessions in cooperation with ASM: Industrial Heating Equipment Association; Metal Powder Industries Federation; Metal Treating Institute; Special Libraries Association, Metals Division; and the extensive programs of the American Society for Metals with the new Bill Woodside Memorial Sessions, and ASM Metallurgical Seminar.

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for all

HARD SURFACING

All hard surfacing jobs can be easily and economically handled with the unmatched Murex line of 88 types and sizes of Hardex electrodes and rods. The wide selection permits exact matching of deposits to service requirements. Whether you weld manually or automatically there is a Hardex electrode to solve your impact, abrasion, or corrosion problems.

Low hydrogen coated Hardex electrodes decrease porosity, improve resistance to cracking, offer shallow penetration with excellent fusion, minimize dilution of weld metal.

For technical assistance or literature described in the box-write *Metal & Thermit Corporation, Rahway, N. J.*

NEW **HARD SURFACING FACT FILE**

Helpful hard surfacing data on convenient 3" x 5" cards. Send for your file—it's free.

MUREX PRODUCTS FOR BETTER WELDING

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SPECIAL ALLOYS

The first welded aluminum bridge, now being built,

AUTOMATIC WELDING with consumable electrode equipment joins one-inch flange to ½-inch web.

Will Aluminum Replace Steel In

IN BRIEF: Aluminum's good strength-to-weight ratio and corrosion-resistance make it a natural for use in highway bridges.

THE FIRST ALUMINUM girder-type highway bridge in the world is being constructed near Des Moines, Iowa, to carry traffic across a four-lane interstate express highway. Structural members have been shipped to the construction site and erection is underway.

The first welded aluminum bridge is a developmental project jointly sponsored by the Iowa State Highway Commission and the nation's three major producers of aluminum: Aluminum Company of America, Kaiser Aluminum & Chemical Corp. and Reynolds Metals Co.

In addition to elimination of costly maintenance associated with steel bridges, it is anticipated that the pioneering project will demonstrate structural and fabrication advantages of aluminum. This could open the way to a much broader use of the light metal in the nation's huge highway construction program.

Designed by Ned L. Ashton, Iowa City consulting engineer, under the direction of the Iowa Highway Research Board and the Iowa Highway Commission, the bridge will be a four-span continuous aluminum girder structure with a composite reinforced concrete deck. It will be 222 feet long and 36 feet wide with a 30-foot roadway. It will be supported by concrete piers.

Four continuous longitudinal girders will be used under the roadway—spaced 9½ feet apart. The girder and diaphragm system will be primarily of welded plate construction, using high strength weldable aluminum alloys. The concrete deck will be tied rigidly to the aluminum girders with aluminum shear connectors to achieve composite action.

Aluminum offers certain structural advantages when used for members designed for composite action with the concrete roadway slab. A reduction in aluminum weight is achieved by

poses this big question:

SEMI-AUTOMATIC WELDING splices girders.

GIANT SUBASSEMBLY is 12-feet high and 126-feet long.

Highway Bridges?

virtue of the fact that a portion of the concrete slab becomes a part of the structural member. The relationship of the modulus of elasticity of aluminum to that of concrete is such that a greater portion of the concrete can be considered as acting with the aluminum than if the member were designed in steel.

Another advantage is reduction in field assembly and erection operations made possible by aluminum's light weight. All welding was done in the shop. The girder system was transported to the job site in sections. These will be elevated into position and then bolted together.

The girder system was fabricated by Pullman-Standard Car Manufacturing Co., Chicago. It was shipped in four big subassemblies, each consisting of an exterior and interior girder with connecting diaphragms. The units are approximately 12 feet wide and range from approximately 95 to 126 feet in length.

Fabrication of the structurals went smoothly according to Pullman-Standard officials. The four longitudinal girders and connecting diaphragms were made from high strength weldable alloy plate ranging in thickness from ½ to 1¾-inches.

A typical main girder has a web ½ by 36-inches, a lower flange 1¼ by 18-inches and an upper flange ¾ by 12-inches. A typical diaphragm has a ½-inch by 23-inch web and 1 by 10-inch flanges.

WELDING DETAILS

The semi-automatic and full automatic consumable electrode process was used. In all, some 1,297 pounds of $\frac{1}{16}$-inch diameter welding wire was consumed. A total of 31,964 cubic feet of 75 helium—25 argon shielding gas mixture was used.

Welds made included 9,581 feet of ¼ to ¾-inch fillets and 500 feet of ½ to 1¾-inch butts. There were 551 feet of vertical fillet welds and 527 feet of overhead welds. Both double-Vee and double-J butt joints were used. These were made by planing, chipping and shearing.

Continued on page 90

SPECIAL ALLOYS

How Stainless Piping

IMPORTANT ROOT PASS is made with consumable insert strip and tungsten arc equipment. Baffle which holds in internal shielding gas is not shown here.

FINAL PASSES are made with submerged arc equipment. Three manual filler passes made after the root pass act as a back-up for automatic welding.

Was Welded For An Atomic Sub

IN BRIEF: You can learn a lot by studying the techniques used to get "perfect" welds in stainless piping for the Navy's U.S.S. Tullibee.

WELDING STAINLESS steel piping for an atomic-powered submarine is not easy.

That's what Midwest Piping Co., Inc., St. Louis, found out when it made 25 sections of primary coolant piping for the Navy's U.S.S. Tullibee. Made from Type 304 stainless, sections are 8-feet long, 8⅝ inches in diameter and have an 0.683-inch minimum wall thickness.

Midwest used three different welding processes and just about every inspection method available to do the job. Welding processes included: inert gas tungsten arc with a consumable insert, manual coated electrode and automatic submerged arc. Their non-destructive tests were ultrasonic, radiographic, dye penetrant, and hydrostatic. They also used physical and chemical tests.

Here's how the job was done:

Stainless plate (⅞ x 27¾ by 102 inches) was selected according to military specifications. They were inspected visually and ultrasonically for the Navy by Midwest and Combustion Engineering, the prime contractor. All blanks were marked individually and with heat numbers.

Preparations for welding were painstaking. Plate was cut by either the powder cutting or tungsten arc process. At least ⅛-inch grinding stock was left after powder cutting, a $\frac{1}{16}$-inch after tungsten arc cutting.

The two ends of the blanks were beveled by grinding with aluminum oxide grinding wheels bonded with resin. Grit sizes were 36 or 30 (depending on wheel used).

Forming was careful. The dies were cleaned thoroughly; and special lubricants were used since prevention of contamination is very important with these materials.

Plates were positioned on stainless steel supports in a natural-gas-fired furnace. They were heated to 1900°-2100°F in a slightly oxidizing atmosphere. Temperatures were measured with optical pyrometers.

Then, in a U-ing die, the plates were U-ed at temperatures of 1800°-2100°F. Optical pyrometers were again used, this time to make sure temperature did not fall below 1800°F.

Next, the U-sections were reheated to 1900°-2100°F and finished in a closing die. Formed sections were then air-cooled on stainless steel plate or fire-brick. The welding groove was machined when plate cooled.

Welding was next. It was done by operators qualified under military standards. The all-important root pass was made by the inert tungsten arc welding process with a consumable insert strip. The insert was used to get uniform penetration without undercutting, to eliminate the need for inside welds in the piping, and to meet inside diameter machining tolerances.

Use of this insert in a longitudinal weld is a somewhat unusual application. Usually, the insert is used as a ring in root passes in circumferential pipe welds.

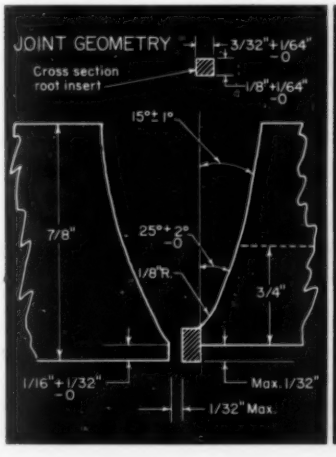
The inserts were ⅛-inch sections sawed from $\frac{3}{32}$-inch stainless plate. Two inserts about four feet long were used in each section.

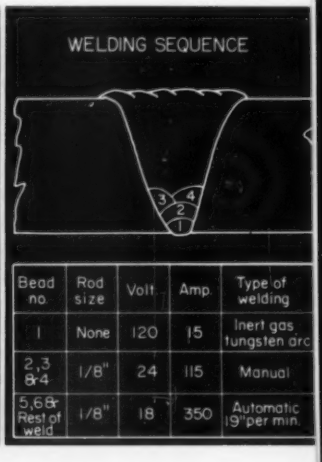
After the weld joint was cleaned with acetone, the root pass was made. A ⅛-inch diameter 2-percent thoriated tungsten electrode was used at 120 amps and 15 volts, direct current and straight polarity. Externally shielding was done with argon at 30 cfh; internal shielding was argon at 5 cfh.

The next three passes were made with ⅛-inch diameter lime coated Type 308 electrodes in the flat position. Weaving of stringer beads did not exceed 2½ times the diameter of the electrode; starts and stops were staggered on passes.

The remainder of the weld was made by the automatic submerged arc process at 19 ipm. A ⅛-inch diameter type, 308 bare wire and suit-

Continued on page 98

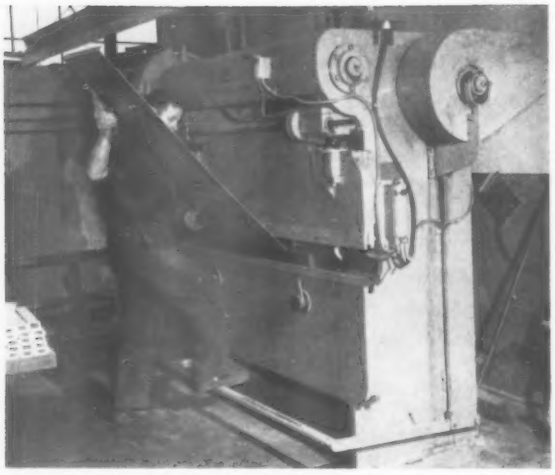




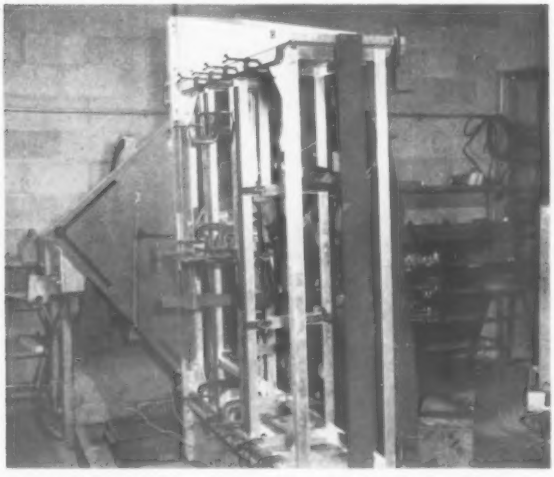
Bead no.	Rod size	Volt	Amp.	Type of welding
1	None	120	15	Inert gas tungsten arc
2,3 & 4	1/8"	24	115	Manual
5,6 & Rest of weld	1/8"	18	350	Automatic 19" per min.

SPECIAL ALLOYS

Techniques For Fabricating Magnesium



FORMING: Brake operator makes 90° bends on hot shell side sheet on a 10-ton brake.



FRAME ASSEMBLY: Positioner permits flat welding. Most welds are done from one side.

IN BRIEF: Rapid oxidation, pre-weld cleaning, heating before forming, danger of fire are problems encountered when fabricating magnesium.

MAGNESIUM IS WELDED with ease at Visioneering Company, Cleveland, Ohio. Why? because this company has a specific solution for each of the five problems they had in fabricating radar control cabinets.

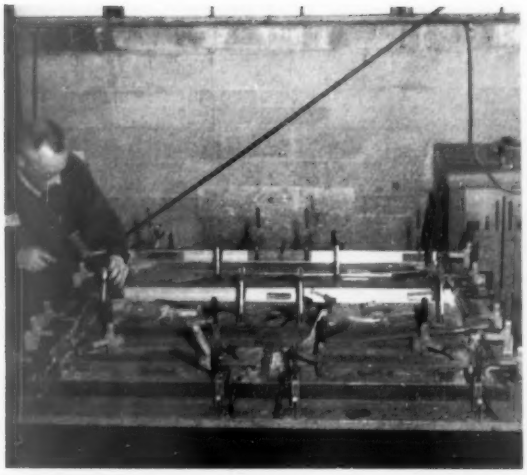
First, magnesium oxidizes rapidly when heated to its melting point in air. To prevent this the company uses the tungsten arc welding process with its protective inert gas shield.

Secondly, magnesium must be protected against corrosion if stored for more than a few hours, but has to be perfectly clean for welding. Visoneering coats stock with cosmolene, then wipes it off with carbon tetrachloride for welding.

Third, magnesium weldments (like those of most other metals) must be held securely during welding and heat treatment to hold tolerances. Visioneering has a welding jig for every sub-assembly, and a jig that prevents frame misalignment during heat treatment. Numerous Toggle-clamps, and over 1200 "C"-clamps, provide the holding force.

Fourth, magnesium cannot be formed cold. So this company heats all sheet stock in a furnace before forming.

Fifth, magnesium dust, powder and particles can fuel a dangerous and destructive fire. That's why a strict safety program was set up to keep magnesium cleaned off collecting surfaces and to keep spark-making steel away from the area. A further precaution: buckets of dry chemical powder (not fire extinguishers) are spotted all around the fabrication shop to nip fires by smothering them.



FIT-UP: Extruded frame angles must fit tight for welding to hold tolerances.

WELDING: Filler wire (Mg, 9 A1, 2 Zn and 0.1 Mn) is deposited in frame joints.

INSPECTION: A straight edge is used by an inspector to check flatness and trueness.

FINAL PRODUCT: Mostly magnesium, has stainless steel hinges and drawer slides.

The radar cabinet is about 99% magnesium. Only a few small parts are stainless steel. The frame is extruded angle, the skin, .091″ thick sheet stock. Cabinets are made in sizes ranging from 4′ x 2′ x 2′ to 4′ x 4′ x 1½′.

Fit-up and welding fixtures for frame subassemblies are similar in type; each has an inch-thick tooling-plate base of magnesium, work-holding toggle clamps, and welding point copper inserts. The lightweight, parallel-surface tooling holds fixture costs down, because it comes ready to use: machining is unnecessary. The copper inserts are recessed about ⅛″ along weld joints to permit 100% penetration.

All frame members are saw cut to length with a carbide-tipped blade. Weld joint edges are chamfered for 100% penetration with a power router set for a 45° angle. Piece-parts are then fitted into subassembly fixtures and welded. Afterwards, subassemblies (sides, top and bottom, front and back) are brought together and tacked. Finish welding is done on a positioner. Visioneering has a plus or minus $\frac{1}{32}$″ tolerance on the frame.

Power for welding is supplied by an A.C. transformer type unit equipped with high-frequency starting. Both $\frac{3}{32}$″ and ⅛″ tungsten electrodes are used to deposit filler wire for the welds. Filler wire is $\frac{1}{16}$″ to ⅛″ diameter type AZ92A rod and comes in 3 foot lengths. Frames are welded at current settings of about 125 amps and 30 volts. Argon shielding gas flows at about 30cfh while the operator welds at 3 inches per minute. The government qualified operators

Continued on page 96

When it comes to joining small assemblies made of

COLD ROLLED STEEL pointers are spot welded to bi-metal element. Automatic feeding of strips of pointers saves $8,000 a year. Operator places element on the upper electrode and steps on foot pedal to make weld.

TIN PLATED post of free-machining steel (right hand) is joined to bi-metal element coil in projection welder. Automatic ejection of assembly from welding fixture saves $2,000 a year over the old manual method.

Resistance Welding: A Fast Way To Join Dissimilar Metals

IN BRIEF: Here's how spot and projection welding join copper, steel and phosphor-bronze to bimetallics.

TEMPERATURE CONTROLS are precision-made on a production scale at Minneapolis-Honeywell Regulator Co.'s downtown Minneapolis plant.

That's why they resistance weld critical parts of their T86 Round Thermostat. Other methods won't give them the strength and quality they need and cost thousands of dollars more in material and labor.

They found these advantages in resistance welding:

1. Reproducible, high quality welds at a high rate of production.
2. Best electrical and thermal conductivity.
3. A way to join materials of different composition and properties, not feasible with other methods.

That's not all. Company engineers are always investigating and improving: changing from one form of resistance welding to another (like spot to projection) or modifying equipment or processes to get the best job, fastest.

There's a lot of welding in the palm-sized T86. Specially interesting is the semi-automatic welding of pointers and bi-metal for the thermometer element.

Pointers are made in a progressive die in 12-inch strips. Strips are loaded in a fixture, which cuts off a pointer and positions it against the welding electrode. The operator puts a coiled bi-metal element on the upper electrode, hits the foot pedal, and welds the pointer. The machine automatically recycles and positions a new pointer.

This automatic feature saves $8,000 a year over fumbling, hand methods.

Pointers are 1010 cold-rolled steel, .010″ thick. The bi-metal element is .006″ thick, ⅛″ wide.

Pointer welders are bench size with half cycle controls, electrodes are RWMA Class II alloy, air cooled. The welding pressure is exerted by a spring in the head and can be adjusted from 0 to 48 lb.

A neat example of projection welding is the joining of a post (tin-plated, free machining stock) to a bi-metal element. The round ⅛-inch post is the projection.

The machine is a 15 KVA bench welder with fully synchronized controls. Stroke is ¼ inch. The head is air operated, gives the low friction, fast follow-up needed for projection welding. Tips are water cooled and are frequently dressed with crocus cloth.

The special offset tips are made of Class II alloy. The bottom one is recessed to take the post; the upper is flat for bi-metal contact.

The operator loads the post and bi-metal in a fixture, makes the weld, and the part is automatically ejected. The ejection setup saves $2,000 a year over the old manual method.

Process changes were made on two other components of the thermostat in order to improve the product.

One was the welding of the .016-inch phosphor bronze tube clip to .018-inch coiled bi-metal. This used to be spot welded, but because it was hard to keep electrodes in shape, the welds weren't always of top quality.

Data for Welding Bimetal to:	Process	Welder	Electrodes
Cold Rolled Steel (.010″)*	Spot	½ Cycle	RWMA Class II, Air-Cooled
Tin Plated Free-Machining Steel (⅛″ dia.)	Projection	15 KVA Synchronous controls	RWMA Class II, Water-cooled
Phosphor-Bronze (.016″)	Projection	4.6 KVA Rocker Arm	RWMA Class II, Water-cooled
Copper Wire (26 Ga.)	Spot	½ Cycle	RWMA Class II, Air-cooled

**Bimetal thickness, .006″; other cases, .018″.*

Projection welding made perfect welds every time. It reduced costs by ending rework and double inspection; kept customers from getting hot under the collar when they got defective parts.

Honeywell uses a 4.6 KVA, foot operated rocker-arm welder on the tube clip-bi-metal

Continued on page 86

6 Joints To Use When Welding Titanium

IN BRIEF: With good joint fit-up and correct welding procedures you get high quality welds in titanium.

A TYPICAL SELECTION of titanium joint types is shown at right. Many other types can be or must be used. These include lap, edge and corner joints.

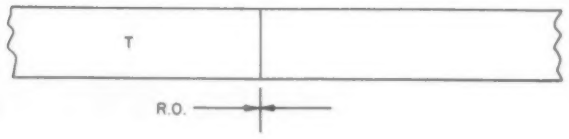
This is a guide only. As such, enough latitude is offered to cover most possible cases. For instance, although the square-butt joint is most common for gauges in the 0.010 to 0.062-inch range for tungsten-arc welding without filler material, in certain cases with excellent fit-up the range might be extended to 0.125-inch. Generally, however, undercutting of the weld bead would present a problem for gauges above 0.090-inch. Therefore, at the 0.125-inch gauge, the optimum joint would normally be designed to have a slight root opening for tungsten-arc welding with filler wire.

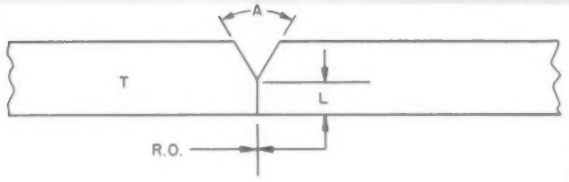
Also, note that the single-vee joint may be welded with the tungsten-arc process using filler wire, or the consumable electrode process. However, in either case, it may be desirable to use a closed-root joint with a land and weld an initial root pass using the tungsten arc without filler. The remainder of the weld can then be made in one or more passes, depending on the thickness of the material, using either tungsten-arc with sidewire filler or the consumable electrode process.

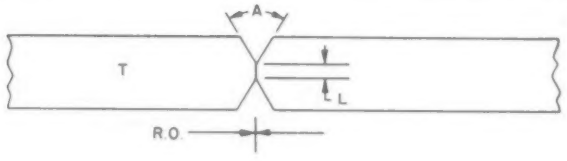
JOINT FIT-UP

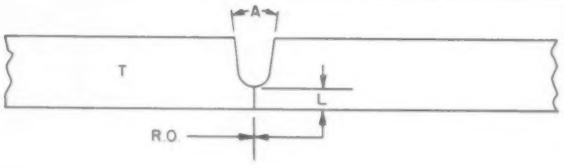
Good welds come with good joint fit-up. This is particularly true in light gauge sheet material (0.100-inch or less). Poor fit-up lets molten metal from adjacent pieces fall through instead of fusing to form a welded joint. It also in-

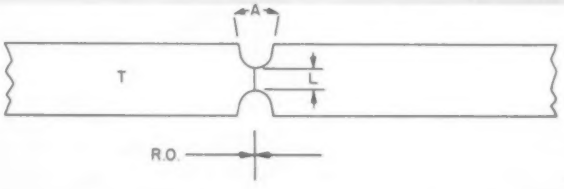
Continued on page 70

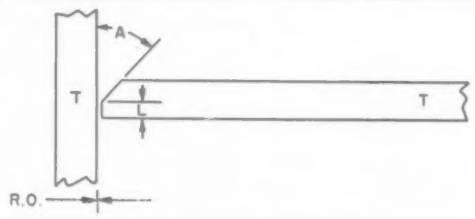












TYPE	Thickness Range, Inches	Weld Passes	Electrode Type	Electrode, Inches Diameter	Filler Wire, Inches Diameter	Root Opening (R. O.)	Angle of Bevel (A)	Land (L)
Square Butt	0.010-0.062	Single	Tungsten[1]	1/16	None	0	—	—
	0.031-0.125	Single or Double[2]	Tungsten	1/16	None	0	—	—
	0.031-0.125	Single	Tungsten	1/16-1/8	1/32-1/16	0-0.10T[3]	—	—
Single Vee	0.062-0.125	Single	Tungsten	1/16-3/32	1/16	0-0.10T	30°-60°	0.10-0.25T
	0.125-0.250	First	Tungsten	1/16-3/32	None	0-0.10T	30°-60°	0.10-0.25T
		Second	Tungsten	1/16-3/32	3/64-1/16	—	—	—
	0.125-0.500	First	Tungsten	3/32-1/8	None	0-0.10T	30°-90°	0.10-0.25T
		Second	Consumable	1/16	—	—	—	—
	0.125-0.500	Single-Multiple	Consumable	1/16	—	0-0.10T	30°-90°	0.10-0.25T
Double Vee	0.250-0.500	Double	Tungsten	1/16-3/32	1/16	0-0.10T	30°-90°	0.10-0.25T
	0.250-0.750	Double	Consumable	1/16	—	0-0.10T	30°-90°	0.10-0.25T
	0.750-1.500	Double-Multiple	Consumable	1/16	—	0-0.10T	30°-90°	0.10-0.25T
Single U	0.250-0.500	First	Tungsten	1/16-3/32	1/16	0-0.10T	15°-30°	0.10-0.25T
		Second	Tungsten	1/16-3/32	1/16	—	—	—
	0.250-0.750	First	Tungsten	1/16	None	0-0.10T	15°-30°	0.10-0.25T
		Second	Consumable	1/16	—	—	—	—
	0.250-1.000	Multiple	Consumable	1/16	—	0-0.10T	15°-30°	0.10-0.25T
Double U	0.750-1.500	Double-Multiple	Tungsten	1/16-3/32	1/16	0-0.10T	15°-30°	0.10-0.25T
	0.750-1.500	Double-First	Tungsten	1/16	None	0-0.10T	15°-30°	0.10-0.25T
		Double-Multiple	Consumable	1/16	—	—	—	—
	0.750-2.000	Double-Multiple	Consumable	1/16	—	0-0.10T	15°-30°	0.10-0.25T
Fillet	0.031-0.125	Single or Double	Tungsten	1/16	None-1/16	0-0.10T	0°-45°	0-0.25T
	0.125-0.500	Single or Double	Tungsten	1/16-3/32	1/16	0-0.10T	30°-45°	0.10-0.25T
	0.250-1.000	Single or Double	Consumable	1/16	—	0-0.10T	30°-45°	0.10-0.25T

[1] Thoriated tungsten electrodes.
[2] Double pass: 1 pass each side.
[3] T: thickness of base material.

Data: Courtesy of Titanium Metals Corporation of America

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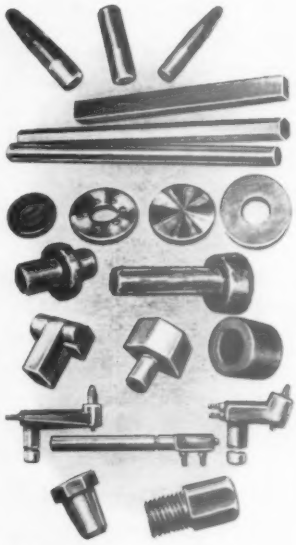

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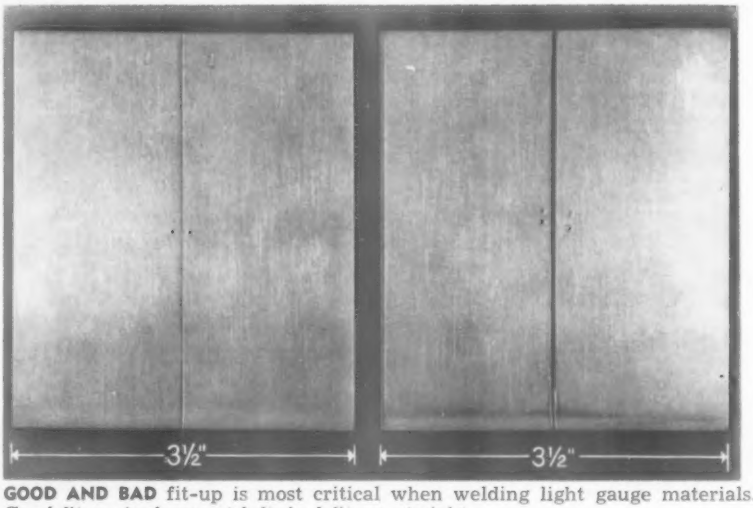
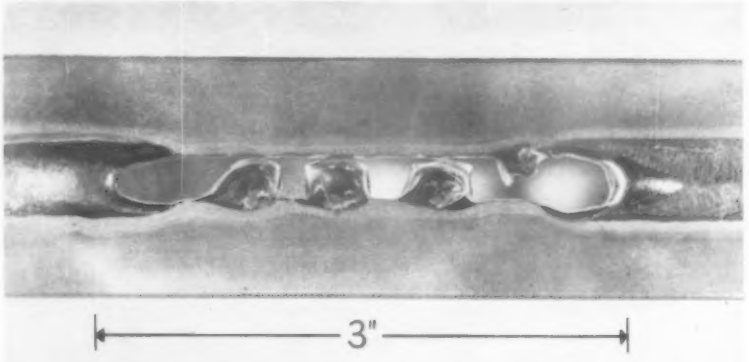
Fit-up: key to sound titanium welds



GOOD AND BAD fit-up is most critical when welding light gauge materials. Good fit-up is shown at left; bad fit-up at right.



BURN-THROUGH can result from poor point fit-up and wrong current settings. Molten metal from adjacent pieces falls through instead of fusing.

creases the possibilty of contamination from air trapped in the joint. The fit-up problem is most critical when welding light gauge material without filler.

It is common practice to shear light gauge material and butt the sheared edges to form a joint. Thus, the condition of the shear and the blade should not be overlooked. A poorly sheared edge made with a dull shear blade should not be used. A cleanly sheared edge will give the best joint fit-up provided there is no bow to the sheared edge. Of course, a straight filed edge will give the best fit-up.

With edges properly prepared, the next important feature of good joint fit-up is clamping. The material edges which are butted together to form the joint must be clamped rigidly to prevent the separate pieces from moving as welding proceeds. Any movement of the material, especially thin gauges, will result in poor joint contour and possibly even burn-through.

Tacking a long seam weld every few inches to prevent a joint from moving is common practice on many materials. But, it is not recommended as good practice when welding titanium. This is because the tacks will usually contain some contamination. This contamination will be further fused into the weld made over the tacks, increasing the possibility of localized weak spots in the weld. • •

IF YOU ARE FABRICATING . . .
aluminum alloys, copper and copper-base alloys, magnesium, mild steel, low and high alloy steels, nickel and nickel-base alloys, stainless steels, titanium, tungsten, zirconium and any other high temperature and special atomic-age materials, including uranium,

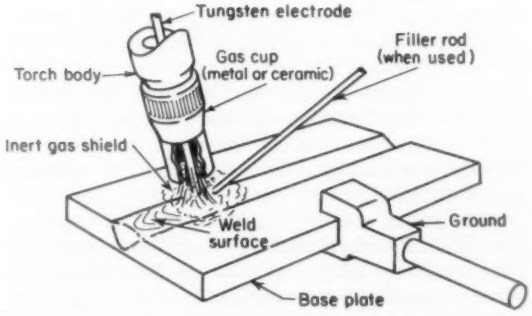
YOU WANT A PROCESS WITH THESE BENEFITS:
is suited for joints not requiring filler rod . . . can weld extremely thin metals . . . gives minimum warpage and distortion . . . has no clean up problems or spatter loss of filler rod . . . has no smoke, fumes or flux blanket to hamper visibility . . . can use filler rod sheared from parent metal . . . gives operator excellent control over build-up in the weld zone and over root pass penetration even without mechanical back-up (but requires more skill to weld fillet joints) . . . can be used on short welds and on unusual shapes and in all positions, including overhead, with minor current adjustments.

An engineer explains . . .

Tungsten Inert Arc Welding

First of four parts **by FRANK KUNCZ,**
Lamp Wire and Phosphors Dept.
General Electric Co., Cleveland

THE TUNGSTEN ARC INERT GAS process was first used on light weight materials and on corrosion-resistant metals which normally had to be flux welded to remove tenacious and refractory-like oxides. (In recent years, industries like the automobile manufacturers have even put it to work on low carbon steels.)



PROCESS: An electric arc between a virtually non-consumable electrode and the work piece provides heat necessary for fusion. An inert shielding gas (argon or helium) protects the electrode and the weld pool from the atmosphere. The electrode is not melted to provide filler metal; when filler metal is required it is fed externally either by manual (as in oxy-acetylene welding) or mechanical means.

TUNGSTEN ELECTRODES

The high melting point of tungsten (6170°F) makes it an ideal, virtually non-meltable electrode material.

Tungsten electrodes are available in a great range of standard and special sizes. Standard lengths are 3, 6, 7, 12, 18 and 24-inches. Standard diameters are .010, .020, .040, $\frac{1}{16}$, $\frac{3}{32}$, ⅛ $\frac{5}{32}$, $\frac{3}{16}$, and ¼-inch.

Electrodes come with two types of finishes: swaged and cleaned or ground. The ground finish produces less heating in the collet because the smoother surface makes better electrical contact.

Electrodes can also be obtained in an embrittled state. These break clean and square whenever breaking is necessary.

Thorium is added to tungsten electrodes because it contributes to greater arc stability, promotes easier starting and increases the span of the operating range. Thoriated electrodes do not contaminate the work as readily as pure tungsten; nor are they as readily contaminated when they come in contact with the work or with the filler material. They run cooler because they allow passage of greater current values per diameter of electrode. The lower operating temperature means less electrode consumption in the arc.

The two percent thoriated electrode further

Continued on page 72

improves the effectiveness of the advantages of a one percent addition cited above. However, it is true that even the two percent thoriated has little or no advantage over the pure when AC balanced wave power sources are used.

Zirconated electrodes are thought by some to be more effective than the thoriated in prevent-

AWS-ASTM Class. Number	Tungsten Minimum Percent	Thorium Percent	Zirconium Percent	Total Other Elements Maximum Percent
EWP	99.5	.....	.....	0.5
EWTh-1	98.5	0.8-1.2	.....	0.5
EWTh-2	97.5	1.7-2.2	.....	0.5
EWZr	99.1	.....	0.3-0.5	0.5

CHEMICAL ANALYSES of tungsten electrodes.

ing contamination, particularly of aluminum and its alloys when using AC high frequency power sources. Some operators claim they perform better than the thoriated. Certain tests have failed to show any substantial advantages, in any realm, over the thoriated material. However, it is a fact that zirconated tungsten is not at all radioactive.

Pure tungsten electrodes are the most widely used because they can be used on the great bulk of welding jobs quite satisfactorily. These are less expensive than the thoriated. However, they will contaminate the work to a greater degree than the thoriated because the tip operates in a molten condition. It will be consumed more rapidly.

Electrode life depends on operating conditions. The life span of any tungsten electrode can be shortened by excessive operating current, improper shielding while operating and cooling or contamination by the work and undue

Elect. Diam.	A.C. Balanced Wave Helium	Argon	A.C. Unbal. Argon	D.C. Straight Either Gas	D.C. Rev Either	Atomic Hydrogen
.010	.....	up to 15	up to 20	up to 15	.....	.....
.020	up to 6	10- 20	15 -25	10- 25	.....	.....
.040	up to 25	20- 30	15- 35	20- 80	.....	5- 25
1/16	25- 30	30- 80	40-120	50-150	10- 20	15- 35
3/32	30- 50	60-130	100-180	100-250	15- 30	20- 60
1/8	40- 80	100-180	150-225	200-350	25- 40	30- 75
5/32	45-120	150-240	200-280	300-450	40- 80	60-125
3/16	50-150	180-300	250-325	400-550	65-105	75-150
1/4	60-250	250-400	300-450	450-750	90-140	75-150

CURRENT CHART tells which current setting to use with which diameter electrode.

breakage.

It is generally recommended that electrode diameters be selected so electrodes will be operating near the top of their respective current ranges. However, current values much in excess of the limit will produce undesired melting of the tip and possible alloying with the base metal. Melting also produces excessive vaporization at the tip.

When electrodes become contaminated, they must be broken or ground to remove contaminated parts and restore arc stability.

Improper shielding, or absence of shielding gas, while the electrode is hot oxidizes the tungsten and changes it to a yellow powder. A good rule of thumb is allow one second per 10 amperes of welding current for gas flow after the arc is extinguished. Do not break off more of the electrode than necessary. If the arc is extinguished immediately after contamination occurs, less electrode will have to be discarded in order to get rid of the contaminated section.

Electrode preparation is important. Grinding a point or taper on the arc end of the electrode helps concentrate the arc, increases the current densities in the arc which stabilize it and permits use of a larger diameter electrode at lower current values without sacrificing stability. A point or taper also improves electrode life by increasing the heat capacity of larger diameter electrodes.

The pure tungsten electrodes will not hold a point; however, the two percent thoriated hold an extremely sharp point exceptionally well on DC straight polarity. With AC the electrode's ability to hold a point will depend on the current value and the power source. Balanced wave power sources will round off a point even at recommended current levels.

SHIELDING GASES

The shielding gases used in tungsten arc inert gas welding must be pure (welding grade argon is 99.995 pure) and clean. They must be free of moisture, so do not interchange the gas and water lines. Of course, there must be enough gas to adequately shield the weld area.

Contamination of the purest gases can cause unsatisfactory welding. Do not use old acetylene hoses or compressed air hoses. Acetylene has a tendency to impregnate the hose. Compressed air often carries oil and water vapors which it deposits on hose walls.

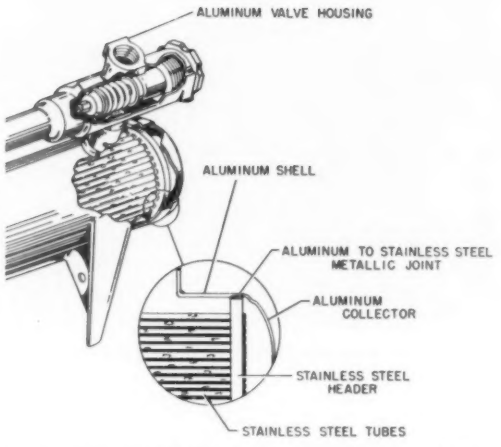
Impurities such as nitrogen form impenetrable nitrides which can cause porosity on subsequent passes of multi-pass work. Hydrogen causes porosity. Air causes excessive oxidation of the electrode, bead-edge scale with a brown to sooty-black deposit and porosity in the weld. Oil vapors produce a surface scum on the weld and in the puddle. This reduces the wetting action and fusion.

Inert gases can be bought in various containers. The standard steel gas cylinder contains 240 cubic feet of gas at a pressure of 2200 psi. Many installations use individual cylinder; these can be manifolded, if necessary. Manifolded cylinder trucks are also available.

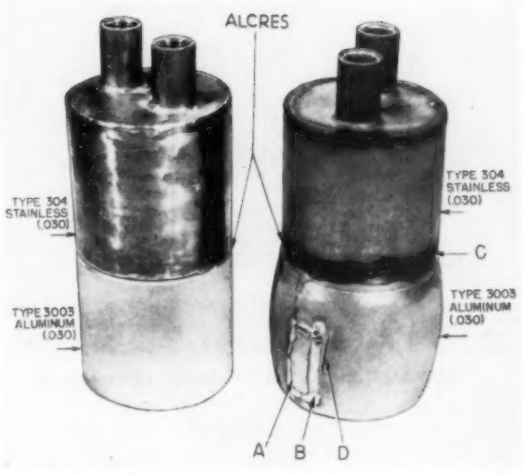
To reduce cylinder pressure to a useable level and to get a constant even flow, an appropriate regulator and flowmeter is needed. The flowmeter allows the required flow of shielding gas (in cubic feet per hour. Solenoid valves

Continued on page 118

You'll see more applications like this now that you can . . .



TYPICAL APPLICATION is this oil cooler in which a stainless steel tube bundle core was brazed into an aluminum shell.



TEST CYLINDER fractured in aluminum (A, B, and D) but not in brazed joint (C). Cylinder (left) withstood low temperature shock tests.

Braze Aluminum To Stainless

IN BRIEF: You can combine the lightness and good heat conductivity of aluminum with the strength, heat- and corrosion-resistance of stainless steel.

A BRAZING METHOD that joins aluminum to stainless steel has been developed by the South Wind Division of Stewart-Warner Corp., Chicago. It's called *Alcres*, a name taken from the *Al* symbol for aluminum and the *cres* for corrosion-resistant steel.

Problem: South Wind needed such a process to join aluminum to stainless in aircraft and missile heat exchangers.

Other joining methods weren't good enough. Fusion and spot welding were out because the metals melt at widely different temperatures; bolted and riveted connections leaked and had stress concentrations that could cause cracks; soft soldering and organic adhesives have limited usefulness in only a very narrow temperature range and on only a few metals.

Solution: The new brazing method results in:

1. A gas- and liquid-tight bond that is resistant to instant thermal shocks at temperatures from minus 320°F to 400°F and higher.

2. The tensile strength of the bond is greater than the parent aluminum at all temperatures.

3. High humidity, organic materials or fungi have no effect on the metallic bond.

The process: The *Alcres* system makes a brazed bond. Brazing is done in a closely controlled furnace at 1100°F which is the flow point of the brazing alloy used. Preparation of materials, composition of the brazing alloy and sequence of operations are keys to a good bond.

The tests: Cylinders made of .030-inch thick aluminum and stainless (see photo), were leak tested at 10 psi.

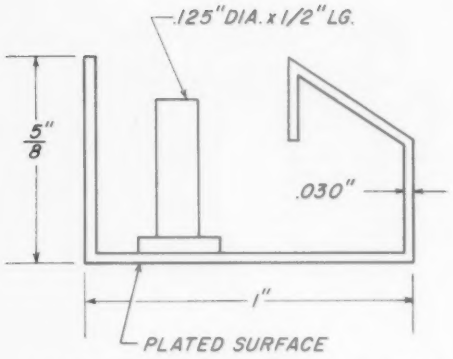
Then they were subjected to 1250 pressure and heat cycles. The temperatures alternated between minus 65°F and plus 500°F. Pressure remained at 20 psi while temperatures changed. There were no leaks.

Next, a test cylinder was pressure tested until it fractured at 224 psi (A in photo). The fracture occurred in the aluminum next to a weld and not in the brazed joint. This break was rewelded and the cylinder retested. Again the rupture took place in the aluminum (B in photo).

To test the effect of high thermal weld stresses on the bond, most of the stainless part of the cylinder was cut off and rewelded—only ¼-inch away from the bond. After pressure testing, the cylinder again failed in the aluminum (D).

Continued on page 99

SPECIAL ALLOYS



PROBLEM: Join steel studs to plated trim.

SOLUTION: Use stored energy percussive stud welder.

Stored Energy Percussive Welding

IN BRIEF: High heat and great speed of stored energy process joins steel studs to chrome plated trim without damaging plated surface.

STORED ENERGY percussive stud welding has opened up a new market for the Ohio Moulding Corp., Wickliffe, Ohio. With it, the company welds steel studs to the backside of chrome plated metal trim without burning through and damaging the plated surface. The job is done without any distortion.

As a result, Ohio Moulding Corp. has been able to expand its services to manufacturers using metal trim and mouldings in a big way. Included are plated products like domestic range bezels, bathroom mirror frames and decorative trim for heaters and home furnaces.

Important Facts on Stored Energy Percussive Stud Welding

Why it is used . . .

Studs up to ¼ inch in diameter can be welded easily to light or heavy metal sheets or strips.

Heating of metals to which studs are welded is minimized. This does away with distortion and annealing problems. It also eliminates burn through on thin sections. Finally, it prevents marring of plating, plastic coating, laminate, paint or polish surfaces opposite the welds.

No flux is required. A precision tip on each stud starts and times an arc when it contacts the workpiece. The tip vaporizes, ionizing the air gap and allowing the main welding current to flow. The arc is timed automatically by the tip length.

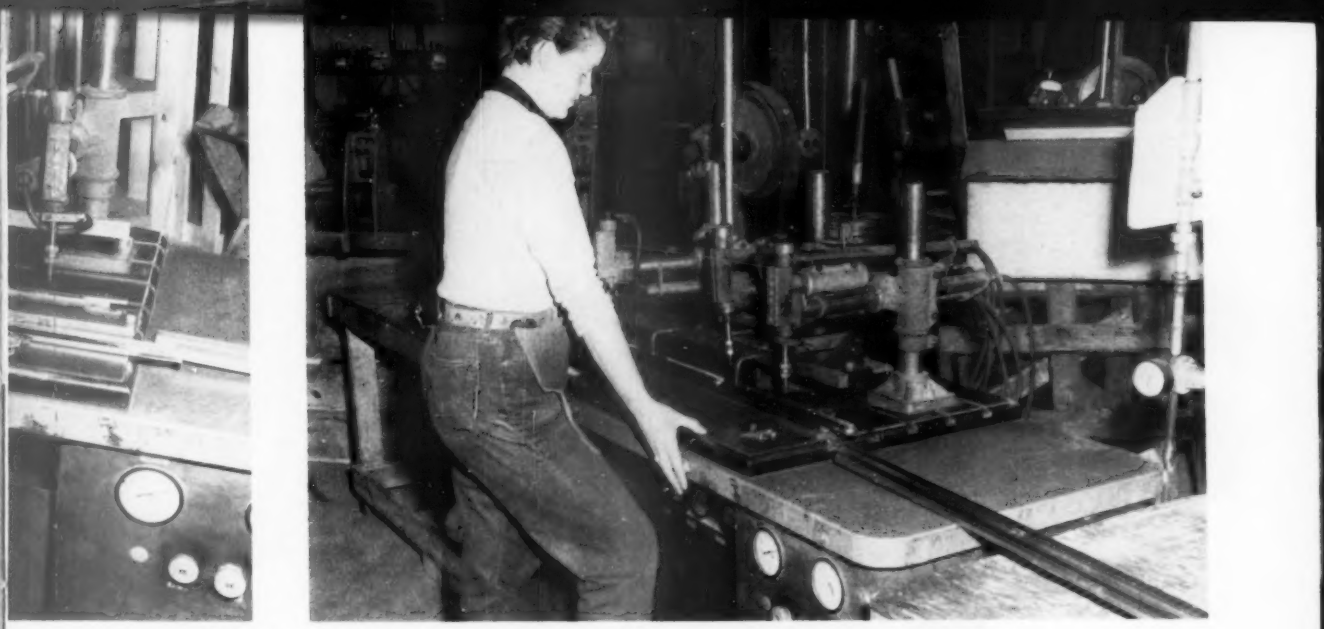
Flow of metal during welding does not extend beyond the stud's periphery. This does away with unwanted fillets.

How it is used . . .

The work is done in a stored energy (capacitor-type) percussive stud welder made by Graham Mfg. Corp. The arc formed during welding melts the face of stud and workpiece. The two molten parts are brought together and fused by pressure.

Welding energy comes from a bank of one or more capacitors. They store enough electrical energy to supply a current density of substantially 300,000 amperes per square inch of stud cross sectional area as the arc is struck. Capacitors can be recharged in 0.8 seconds.

Although instantaneous current flow is of great magnitude when the arc is struck, the time period is very short: one milli-second for



RESULT: Make a joint without burning through and damaging plated surface.

Joins Steel Studs To Plated Trim

The latter is a typical job. Four ⅛-inch diameter mild steel mounting studs are welded to the backside of the .030-inch thick chrome plated steel trim.

Work is done in a multiple-gun Model 2000 bench welder made by Graham Manufacturing Corp. Two guns are used to weld studs in place at one time. Then trim piece is moved and two more welds are made.

The trim piece is first positioned in a welding fixture. Then the operator manually loads studs into the welding guns, steps on a foot pedal to clamp the work in position and presses two palm buttons which start the welding cycle.

The machine does the rest: welding time is one milli-second! • •

---

the complete discharge cycle. This means total welding energy involved is small.

The welding potential is low: about 80 to 90 volts D.C.

Current flow is adjusted in two ways. The number of capacitors in the welding circuit is varied. Or, the voltage of the charged capacitors is changed.

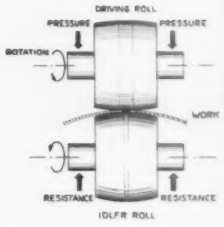
It is possible to "gang" welding guns so two or more studs can be welded to the same workpiece at the same time. When such a setup is used each gun is energized from a separate capacitor bank connected to it through electrically-or pneumatically-operated contactor. Guns are operated by individual control so they can be used together or separately.

Where it is used . . .

The stored energy percussive stud welding process is ideal for mass production. In fact, the only real limitation on welding rate has been the speed with which studs and work pieces can be supplied to the welder. Portable equipment is also available.

This patented process can be used in a wide range of industries, including shipbuilding, aircraft, appliance, furniture, automobile assembly and construction work.

It can be used on ferrous metals and many non-ferrous metals. Typical applications include joining steel studs to steel, steel studs to stainless or plated steel, steel to copper, aluminum to aluminum, brass to aluminum and aluminum to die cast zinc.



PROCESS: Work is fed into hardened steel rolls which cold roll the weld. Rate of travel is up to 108 ipm; pressures from 10 to 20,000 lb. depending on joint makeup.

Cold-Working Relieves Weld Stress, Eliminates Metal Removal

by **H. L. MEREDITH,** *vice president, Airline Welding & Engineering, Hawthorne, Calif.*

IN BRIEF: Here's a way to eliminate locked-up stresses from butt welds and make them flush with the base metal in one operation.

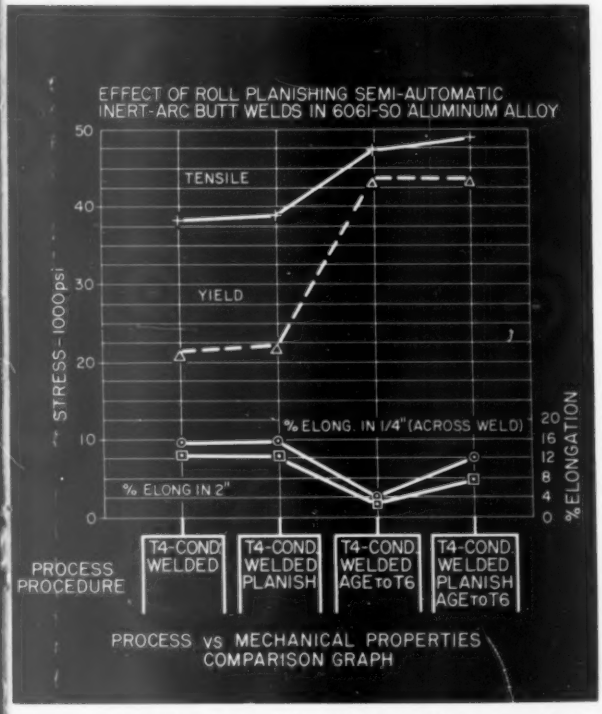
WHY WOULD YOU want to cold work a butt-weld in light gauge metal? There are two main reasons: One is to improve joint properties, the other is to make the weld flush with the parent metal without metal removal.

As-deposited welds are actually castings. They are full of longitudinal and transverse stresses set up by shrinkage, expansion and contraction. These stresses extend into the parent metal in proportion to the amount and penetration of weld heat and the ability of the parent metal to relieve heating and cooling stresses plastically. These stresses cause distortion; they lessen the efficiency of the weldment.

Roll planishing is an effective way to cold work the columnar weld structure and, to a degree, the transition structure in the heat-affected zone. This relieves the thermal effects of welding, matches base metal and weld metal properties more closely.

In addition, planishing makes the weld crest and root beads flush with the parent metal—with little, or no, extra finishing.

Roll-planished welds are smooth, flush, stress-free


EFFECT OF ROLL PLANISHING SEMI-AUTOMATIC INERT-ARC BUTT WELDS IN 6061-SO ALUMINUM ALLOY
STRESS - 1000psi
% ELONGATION
TENSILE
YIELD
% ELONG. IN 1/4" (ACROSS WELD)
% ELONG IN 2"
PROCESS PROCEDURE
T4-COND WELDED
T4-COND WELDED PLANISH
T4-COND WELDED AGE TO T6
T4-COND WELDED PLANISH AGE TO T6
PROCESS VS MECHANICAL PROPERTIES COMPARISON GRAPH

EFFECT: Mechanical properties of butt welds in 6061-SO aluminum are improved by cold working.

COST COMPARISON
Normally Welded Cone:.....$2.70
Aluminum filler wire (4043-S).....$0.0680
Microshaving labor (both sides).... 0.7650
Abrasive smoothing (both sides).... 0.9350
Abrasive belts (2 at 16c)..... 0.3200
Welded and Planished Cone..... .16
Tacking tab welding wire..... 0.0005
Microshaving labor, tab tacks..... 0.0850
Roll planishing labor 0.0850
EFFICIENCY COMPARISON
Joint efficiency of the planished cone weld was rated at 100%. The most an unplanished weld could rate was 80%. The higher efficiency means thinner, therefore lighter materials. No extra beef-up is necessary.

RESULT: Smooth, flush weld joints in regular shaped parts that will be later formed or coated.

Is this an advantage? Sure, especially where weldments are to be processed further; bulge-formed, stretch-formed, spun or sized. Eliminated are the notch effects produced by changes in section thickness or by stress concentrations resulting from thermal effects.

In addition, the flush, smooth surface created by planishing is excellent for accepting glass, plastic or paint coatings.

Planishing machines are designed to cold-work and smooth welds in any metal, including titanium, zirconium and the newer alloys ranging in thickness from .005″ to .093″. Cones, cylinders or other regular shapes up to 16′ long, with diameters ranging from 1¾″ to 10′, can be planished on this equipment.

On one machine, the upper arm contains a fulcrum beam upon which is mounted a contoured, hardened roll driven by a gear motor and a chain. Force is applied by a solenoid-controlled pneumatic cylinder and is adjustable by means of a single stage air regulator. A lower arm supports an idler roll.

How does it work? The operator positions the weld seam on the lower roll and depresses the foot switch. The upper roll descends, contacts the work and the roll turns. This drives the part inward as fast as 108 ipm. Pressure is adjustable between 10 and 20,000 lb., depending upon the nature of the weld, the thickness of the work and the requirements of the metal.

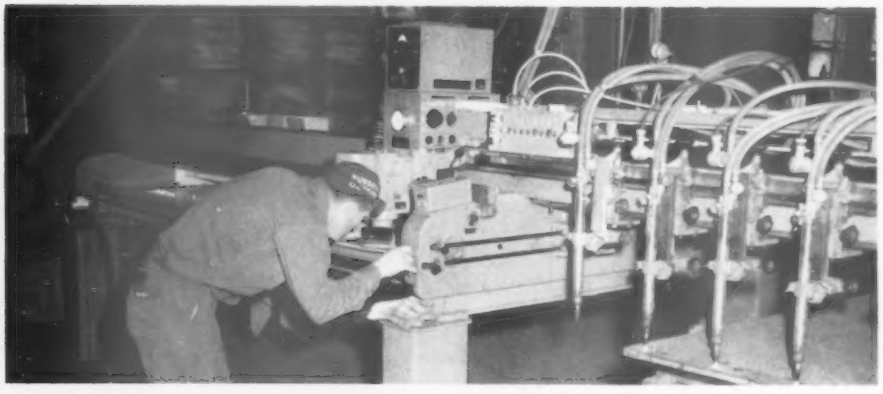
On some roll planishers the work is hand guided. Other models are fully automatic.

Can cold working save money on light-gauge work? A typical case study indicates it can. Identical truncated missile cones made of 6061-SO aluminum were processed in two ways: One was inert arc welded with filler metal and the weld beads shaved and ground; the other was fused without filler metal, then roll planished. The cones were 6″ diameter at the smaller end; 20″ diameter at the larger end, with the true length of the longitudinal weld 60″. Both cones will be spun or bulge-formed, so the weld joint must be smooth and flush.

What were the savings? A neat $2.50 (rounded off) per cone. Most of the difference came from savings in filler metal and from virtual elimination of metal removal steps. You see,

Continued on page 86

MULTIPLE-TORCH cutting machines turn out precision work at Thew Shovel.



EASY-TO-OPERATE electronic tracer is the key to accurate cutting.

Flame Cutting Small Parts Cuts Operating Time 511%

by **WERNER GALLO**, *welding engineer, Thew Shovel Co., Lorain, Ohio*

IN BRIEF: Thew Shovel Co. saved $6,700 when flame cutting replaced shearing of small-piece parts.

FLAME CUTTING is the most economical way to make small piece-parts. We found that out at Thew Shovel when we experimented with 200 of them. Used in our all-welded earthdigging and moving machines, these parts range in area from a few inches to a few feet square and in thickness from ⅛ to 6-inches.

We used to shear parts up to one-inch thick; or we sheared and flame cut. Then we tried making parts by flame cutting alone.

The results were amazing! Setup time was about the same for all parts; but we slashed operating time anywhere from 10 to 511 percent; multiple torch cutting turned out from two to eight identical pieces in the same time it took to shear one piece.

We saved $6,700 (based on present production rates). Our biggest savings was eliminating the helper usually needed in the shearing. We also saved by being able to buy steel in larger and more economical mill sizes. We couldn't when we sheared.

Even more important, quality has been consistent and at the highest level since we adopted flame cutting.

We have not yet taken full advantage of flame cutting. But, we will. Right now, our Produc-

Continued on page 92

SAVE 80% OF SHIELDING GAS COSTS

If You Pay More Than 1½¢ Per ft. for Shielding Gas . . . You're Paying too Much!

A new all-CO_2 gas process by Liquid Carbonic saves approximately 7¢ on every foot of shielding gas used. Expensive argon or helium are entirely replaced by low-cost CO_2 in metal-arc gas shielded welding of carbon steels.

High quality, high speed welds

The new Liquid Carbonic all-CO_2 MAGS process (metal-arc gas shielded welding) produces welds which are equal or superior in both speed and quality to welds made with argon or helium shielding.

Adaptable to both hand and automatic equipment

Your present equipment can probably be used, either "as is" or with modifications. There is no extensive "change over" period with the new Liquid Carbonic all-CO_2 MAGS welding process.

Low cost multiplies the possibilities

By greatly reducing shielding gas costs, Liquid Carbonic's all-CO_2 MAGS process makes the many advantages of shielded gas welding available for even "low budget" applications.

A special welding grade CO_2 gas

CO_2 specifically manufactured for gas shielded welding has been developed by Liquid Carbonic. This gas is of the highest purity and packaged in specially marked 50 lb. (435 cu. ft.) cylinders. New Red Diamond Welding Grade CO_2 assures the highest possible metal-arc gas shielded welding performance.

World's Largest Producer of CO_2

LIQUID CARBONIC

DIVISION OF GENERAL DYNAMICS CORPORATION

Welding a pulley with Liquid Carbonic's new all-CO_2 MAGS process. In addition to cutting welding costs, new process virtually eliminates warpage because of reduced heat input.

Complete technical and operating data available

Write for your free copy of Liquid Carbonic's fact-filled new booklet on all-CO_2 metal-arc gas shielded welding.

MAIL THIS COUPON

LIQUID CARBONIC
DIVISION OF GENERAL DYNAMICS CORPORATION
Dept. 940 • 135 South LaSalle St. • Chicago 3, Illinois

Please send me complete technical and operating data on Liquid Carbonic's new all-CO_2 process of metal-arc shielded welding.

Name_____

Title _____

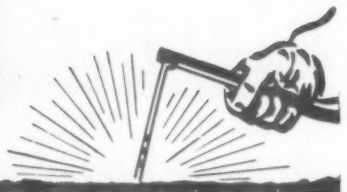
Company_____

Address_____

City_____ Zone____ State_____

Circle No. 69 on Reader Service Card.

Weldynamics



ARC WELDING AT WORK CUTTING COSTS

A special Jetweld for deep groove welds

Jetweld 2 is a special electrode designed particularly for groove welding. The high deposition rate gives maximum speed in fabrication. The excellent wash-up characteristic and complete freedom from undercut makes the slag easy to remove. Deposits are uniformly of X-ray quality.

No electrode gives faster welding and lower cleaning time. Try Jetweld 2 in your shop.

Lincoln men, trained in Weldynamics, will help you select the best electrode, machine and procedures for lowest welding costs.

Write for Bulletin 7000.1, New Weldirectory of Lincoln Mild Steel Electrodes.

The World's Largest Manufacturer of Arc Welding Equipment

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THE LINCOLN ELECTRIC COMPANY, DEPT. 1844, CLEVELAND 17, OHIO

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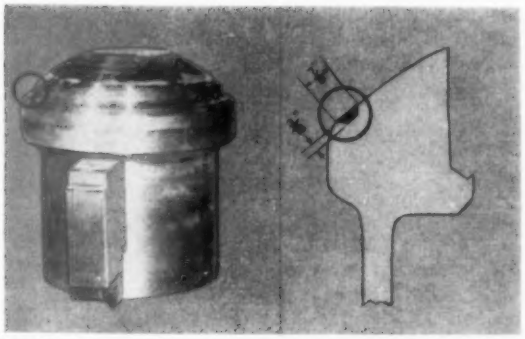
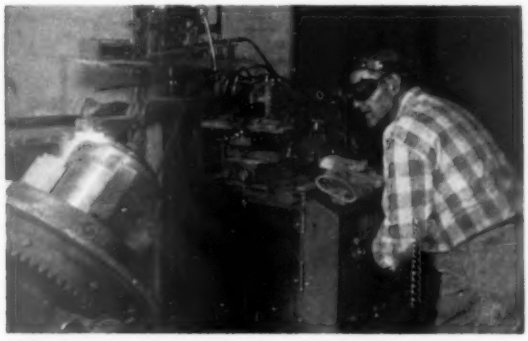


1 Cast steel disk for steam valve is surfaced with a cobalt-base alloy deposited by mechanized hard surfacing equipment.

2 Disks are preheated in an electric furnace located near the surfacing station so the part can be transferred quickly.



3 Parts are positioned in jaws of fixture mounted on the power-rotated table of a conventional welding positioner.

4 Six-foot long rod is positioned in fixture and feeds by gravity. As many as six rods can be deposited at one time.

Mechanized Valve Surfacing With The Oxy-Acetylene Flame

by **J. F. BARNES,** *asst. general supt., Schutte and Koerting Company, Cornwell Heights, Penna.*

IN BRIEF: Porosity, cracking and rough surfaces were eliminated when a mechanized surfacing set-up replaced a manual one.

THE BEST WAY to protect seat rings and disks for high-pressure steam valves is to hard face them. We use a cobalt-base alloy deposited by the oxy-acetylene process.

Background: The cobalt-base alloy we use contains about 60% cobalt, 30% chromium, 8% tungsten and 1.35% carbon. This alloy has excellent resistance to abrasion at temperatures up to 1500°F. It regains its full-hardness upon cooling and resists thermal shock. It will not seize or gall under metal-to-metal operating conditions and is not affected by a great many corrosives.

We use the oxy-acetylene process instead of electric arc. We think it gives us a better chance for a non-porous deposit with a minimum of dilution. The intense heat of the electric arc process (about 6000°F against about 5000-5500°F for the oxy-acetylene flame) sets up thermal shock characteristics. It also creates a greater difference of expansion between the deposited alloy and the base metal. These lead to cracking.

In our opinion the oxy-acetylene flame gives an operator better control over the flow of molten metal. This results in a smoother deposit.

Continued on next page

The inert-gas-shielded method also provides an excellent deposit. But, it costs more.

Problem: Until a year ago, the cobalt-base alloy was applied manually on all rings and disks. (We still do it that way on those up to 4-inches in diameter.)

However, manually hard facing rings up to 46-inches in diameter is tough. No matter how skillful the operator and no matter how much care he used, we continued to get porosity and cracking. We knew this was caused by our inability to hold these massive parts at a uniform temperature for the 2½ hours needed to surface them. It just took too long to do the job.

We found, too, that deposits on the larger rings were rough and uneven. Machining was difficult and we broke a lot of cutting tools. Manual manipulation and operator fatigue was the cause.

In addition, we were falling behind in our normal production schedules. And, we had several rush jobs coming up. Not only did we need a faster method of surfacing, but we also had to reduce finishing time and keep rejects to a minimum.

Solution: We found the answer to all of our problems. We developed a mechanized method of surfacing seats and rings over 6-inches in diameter.

Parts are positioned on an adjustable-speed turntable. This is a conventional welding positioner whose table is power rotated. The table top can be tilted so parts are held in the most convenient position. Fixture jaws can be locked to hold parts level.

The machine itself is equipped with two water-cooled blowpipes fitted with multi-flame heads. These heads are also adjustable so flames can be directed where needed.

The alloy used is supplied as a rod about 6-feet long. It is held upright by passing it through a slotted fixture and then through a set of soft metal or rubber rolls. Once the surfacing operation is underway, the rod feeds by gravity. As many as six rods can be deposited at one time.

The machine also is equipped with a control panel. Located here are the valves for controlling oxygen and acetylene flow, quick shut-off valves and the regulator dials.

How it's done: Here are some of the steps used in surfacing a typical ring and a typical disk.

The ring is a steel forging weighing 69-pounds. It has an outside diameter of 13½-inches and an inside diameter of 10½-inches. The seating area to be faced is one-inch wide. A groove one-inch wide by $\frac{3}{16}$-inch deep is machined in the seating area prior to hard facing. The finished groove must have an RMS finish of 125.

The disk is cast steel and weighs 204-pounds. The area to be faced is ⅞-inch wide. The groove machined in this part is also $\frac{3}{16}$-inch deep. The plug is 12-inches high and has a diameter of 11½-inches at its widest area, tapering down to approximately 9½-inches.

We put parts in an electric furnace where they are uniformly heated to about 700°F. The furnace is close to the hard-facing station so the part can be positioned quickly on the turntable.

Hard facing requires adequate preheat, proper proportioning of the welding flames and heat balance. In an ideal heat balance, preheating should be a true preheat of the base metal . . . raising or, as in this case, maintaining its temperature so that the surfacing metal can flow onto it with only a minimum of assistance from the welding flames. The best type of preheat is that which produces a gradual temperature gradient throughout the piece. These small flames provide close control, avoid overheating, can be directed where needed, and do not create large volumes of ambient gases that do little more than heat up the apparatus.

We sometimes use additional blowpipes to

Continued on page 88

8 REASONS WHY S & K SWITCHED TO MECHANIZED SURFACING:

1. Uniform and smooth deposit results in greater ease of machining and longer tool life.

2. Improved work quality is evident; operator is less tired and can observe progress of the deposit.

3. Following conditions can be regulated: number of rods used, rate of deposit, number of preheat and rod melting heads needed and part's preheat temperature. This means production standards can be determined more readily.

4. Less oxygen, acetylene and rod is required per part. For example, we used ½ pound of ¼-inch rod on the seat and also on the disk. This is about 25 percent less rod than with manual surfacing. We used 60 cubic feet of acetylene and 79 of oxygen —again much less than with manual surfacing.

5. There is less operator fatigue. Only a minimum of manual effort is required to make equipment adjustments.

6. Training of new operators is simplified because procedures can be standardized easily.

7. Increased per-shift production results in a lower overhead cost per piece. We have increased production with out adding additional equipment or personnel.

8. Maintenance costs are low. In over 15 months of service, only four hours maintenance were needed to clean quick shut-off valves and renew packing.

General Electric Tungsten Electrodes are designed for any inert gas arc welding job

NO matter what kind of inert gas arc welding work you do, there is a General Electric Tungsten Electrode that will fulfill your needs. General Electric Hi-Purity and Thoriated Tungsten Electrodes have been used successfully for years in every kind of job where inert gas arc welding is required. Also Hi-Purity Electrodes are widely used in atomic hydrogen welding.

General Electric Electrodes are the result of engineering leadership, extensive research, and the development of quality control methods that guard the high standards of perfection. Ask your nearby welding supplies distributor for these three types of G-E Tungsten Electrodes:

① **HI-PURITY TUNGSTEN**—Manufactured from 99.95% pure tungsten metal powder and recommended for most inert gas welding jobs. (AWS standard is 99.50%).

② **1% THORIATED TUNGSTEN**—Made from 98.75% pure tungsten metal powder containing 1% thoria. (AWS standard is 98.50%.) You get easier starting, greater arc stability over a wider range of currents, longer life, more resistance to contamination by contact with molten weld pool.

③ **2% THORIATED TUNGSTEN**—Made from 97.50% pure tungsten metal powder containing 2% thoria. (AWS standard is also 97.50%.) Same benefits as the 1% Thoriated Tungsten but to a greater degree.

General Electric Tungsten Electrodes are produced by the world's largest and most experienced manufacturer of quality tungsten products. All have either a cleaned or a mirror-like ground finish. The ground finish is necessary, when high currents are used, to minimize contact voltage loss and overheating of the collet. They are free of cracks, seams and slivers, and retain their rigidity even at extreme temperatures.

Available in seven standard diameters from 0.040 inch to ¼ inch—8 standard lengths from 3 inches to 24 inches. Other lengths and diameters (up to one inch) can be made to special order. For further information, write: General Electric Co., Lamp Metals and Components Dept. IW-108, 21800 Tungsten Road, Cleveland 17, Ohio.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Circle No. 46 on Reader Service Card.

This message is for men who are vitally concerned with such welding problems as maintaining a smooth flow of production... preventing excessive rejects... and insuring trouble-free, economical, profitable operation

Welding Wire: Cost-saving and Profit Factors

Production men who are conscious of *both cost and quality* agree that a top-grade weld demands the *right* welding wire. *Only* by using wire with an analysis suited to the material to be welded can consistently sound welds—free from porosity and internal cracks—be produced. Use of the right wire means fewer rejects, less waste, lower costs—plus a better finished part or product.

Experienced welding men have long found PAGE a most reliable source of welding wire for all their regular and special needs. The wide range of PAGE analyses—33 of them—makes it possible to select the exact wire that produces the kind of welds that lower production costs and increase profits.

PAGE experience, talents and facilities are available to you at all times. We have been exclusive wiremaking specialists for more than half a century, and are in an ideal position to furnish our customers with the right wire for each specific need. Furthermore, we have developed a broad packaging program which saves time and money by supplying wire packaged to meet any requirement.

These factors, plus PAGE'S nationwide set-up of conveniently-located distributors, backed up by PAGE warehouse stocks, help make it profitable for you to standardize on PAGE Welding Wire.

Write for—Welding Wire **Comparison Chart DH-1218** (shown above). This highly informative, four-page chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Also shows uses and physical properties, including: tensile strength, elongation, Rockwell hardness. Chart lists virtually all competitive makes.

•

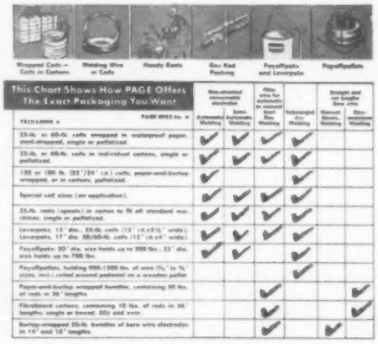
***NOTE** • Look to PAGE, not only for automatic welding wire, but for gas welding rods, bare electrodes, metal spray wire*

• • •

Write for—Submerged arc and inert gas welding wire **Folder DH-402A**... also gas welding rod **Booklet DH-1277.**

drum... ready to be smoothly unreeled to the welding head for automatic or semi-automatic welding! Eliminates costly machine down-time for coil replacement. Payoffpaks come in three sizes: 20" diameter (holds 250 or 500 lbs.); 23" diameter (holds up to 700 lbs.).

• • •



Write for—**PAGE Welding Wire Packaging Chart.** • This useful chart shows the many kinds of packaging of PAGE Welding Wires for each type of welding.

PAGE offers— 33 ANALYSES ...the right analysis for your welding job

There are *33 different analyses* in the PAGE line, covering the broadest range of applications: submerged arc... inert gas... tungsten or metal arc... oxy-acetylene gas welding... metal spraying.

For example—

ANALYSIS A-S-65... This reasonably priced hard facing material, with inert gas, a neutral flux, or oxy-acetylene flame, deposits a machinable overlay (from Rockwell B-95 to B-99) which hardens under impact to Rockwell C-10, and resists abrasion and erosion. A-S-65 is also used for build-up where a final layer of hard facing material is to be used.

For example—

ANALYSIS A-S-ARMCO IRON... Famed for purity and dependability, Armco Iron contains less than .10% total quantity of other elements. Armco Iron Filler Metal—exclusive with PAGE—is favored by high-quality producers for very limited analysis ranges, where alloying elements are to be added, either through a flux or a coating.

NOTE: previous advertisements in this publication have included brief descriptions of PAGE Analyses A-S-8620, A-S-6150, A-S-30 and A-S-NAX-9115. Detailed information on all 33 PAGE analyses is contained in our Welding Wire **Comparison Chart DH-1218.**

PAGE offers— Packaging to meet your needs

PAGE Welding Wires are packaged in a wide variety of ways—for the most complete protection and the utmost convenience in handling, in stocking and in use. Here are some major types of PAGE packaging:

1. **Paper-wrapped Coils**
2. **Coils in Cartons, Palletized**
3. **Bare Coils (packed in Leverpaks)**
4. **Masonite Reels**
5. **Payoffpaks**
6. **Payoffpallets**
7. **Gas Rods in Burlap-wrapped Bundles**
8. **Stainless Gas Rods in 10-lb. Tubes**

For example—

PAYOFFPAKS... Up to 700 lbs. of wire, without a single weld... coiled around a fiberboard cylinder within a fiberboard

PAGE offers— Availability from local stocks

Here is a handy service that not only gets you the welding wire you need when you need it, but saves you money by making it unnecessary for you to tie up a sizeable investment in wire inventory.

You can get the exact PAGE automatic welding wire and welding rods your job requires direct from your nearby PAGE Distributor. Located at many points from coast to coast, PAGE distributors carry sizeable stocks for your convenience—and they are backed up by PAGE Warehouses at the strategic locations shown below. Close cooperation between PAGE distributors, PAGE warehouses and the PAGE mill is your guarantee of prompt, intelligent, individual service on your specific needs.

ACCO

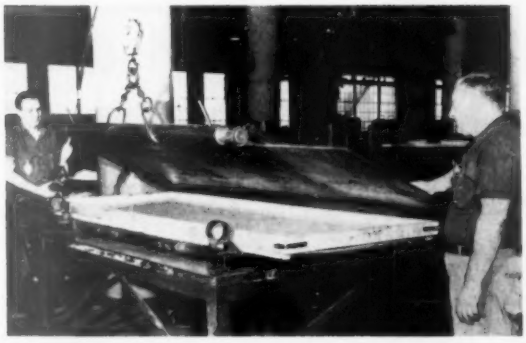
Page Steel and Wire Division
AMERICAN CHAIN & CABLE

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*
Los Angeles*, New York, Philadelphia*, Portland, Ore.
San Francisco*, Bridgeport, Conn.
**Indicates PAGE warehouse stocks*

ACCO for Better Values

Circle No. 81 on Reader Service Card.

Save 50% storage space and 90% handling time



SHEET STOCK is transferred from crate to "book" which holds 2000 pounds. Books in turn are filed away by size and type of contents.

STORAGE AREA holds 1300 books. Each carries a tag listing complete characteristics of contents and a perpetual inventory.

TWO MEN and an overhead traveling crane transfer a book from storage area to a V-rack to remove desired sheets.

Stop Man-Handling Alloy Sheets

IN BRIEF: A new handling system eliminates damage to costly metals, makes possible speedy handling and cuts storage space to a minimum.

A SPECIAL sheet stock handling system has saved Pratt & Whitney Aircraft up to 90 percent in handling time and has saved 50 percent in floor storage space. Installed at the company's East Hartford, Conn., plant, the system has also eliminated delivery lead time and damage to expensive sheet stock.

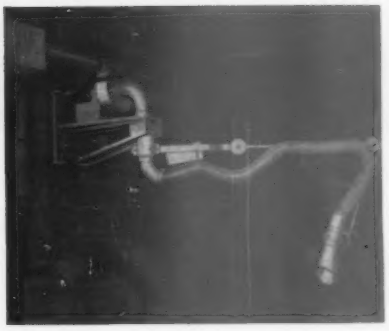
Developed by Acme Welding of West Hartford, Conn., the system operates like a library. When a crate is received, it is placed on a welded steel transfer rack. After that, all handling is done by an overhead traveling crane.

Once the crate is on the transfer rack, its top is removed and replaced with a welded steel plywood "book" cover which is connected to the transfer rack with a steel "book" hinge. Then the crate is turned over by a special hoist bar. The transfer rack and the other side of the crate are removed and replaced by the second book cover. Then the completed book is swung into its proper position in vertical steel racks, immediately available when needed.

The installation at Pratt & Whitney is the largest of its kind to date. Over 1300 books used range in size from 2 by 8-feet to 5 by 12-feet. Each carries a tag containing complete characteristics of the contents and a perpetual inventory. All are numbered and a record kept of their location in the storage area.

The system stores 2000 pounds of material every six inches. It consists of four basic elements. Besides the welded steel transfer rack, the vertical steel storage racks, or bookcase and the book itself, there is a mobile V-rack for moving a book to any remote point in the plant. This is important when a shear cannot be located in the storage area. • •

Save and be sure with . . . ENGWALD



Welding fume exhausters

- Systems have been approved for Government Health Depts. in U.S. & Canada.
- Guaranteed for highest efficiency.
- Portable & Stationary units for all applications.
- Unlimited flexibility; fast, easy positioning over 360°.
- Blowers attachable to units or mounted at remote points.
- Units can be connected in series.
- Available in 9, 12 or 15-ft. reach units.
- Complete installations can be easily done by your own men.
- Engwald Exhausters come complete with mounting brackets.

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ENGWALD CORP.

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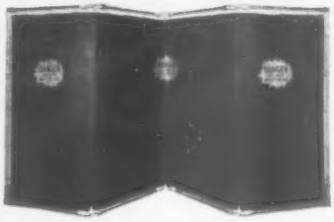
NEW FROMMELT PORTABLE FOLDING

WELDING SCREENS



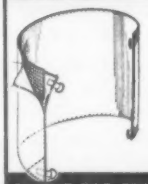
WITH APPROVED WELD-O-RAMA CURTAIN

Use them as folding partitions, wind breaks, or room dividers in any length. Self-standing, light weight, easily transportable. Folds compactly for storing as illustrated. In UL approved treated duck or Weld-Tex (Neoprene Coated Glass Cloth) resistant to fire, water, mildew, weather. Stock and special sizes.

PORTO WELDING SCREEN KIT

Assembles with your standard pipe or tubing. Forms a rugged, portable, low-cost, fireproof shield that folds compactly for storage or carrying. In UL approved duck or Weld-Tex glass cloth.

Spa-Hi WELDING SHIELDS



Flexible wire insert between UL approved fire, water, mildew-resistant fabrics permits forming around the job. Light weight, compact, easily carried or stored.

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FROMMELT INDUSTRIES

DUBUQUE, IOWA

Fabricators of Approved Safety Products

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RESISTANCE WELDING *continued*

weld. The projection in the clip gives the right heat balance between these widely different materials.

Projection welding tips are easy to maintain, too. Distributed pressure and water cooling are responsible.

The lead wire on this same bimetal part used to be soldered. But this slow, hand work resulted in joints that varied in conductivity and strength, and in the quantity of solder in the joint.

Resistance welding takes away the human element, makes every joint as good as the last one and a good conductor.

The multi-strand copper lead wire (26 gauge) is welded with offset copper alloy tips on half-cycle bench welder. Tips are air-cooled, flat and last 2 or 3 weeks with constant use. • •

COLD WORKING *continued*

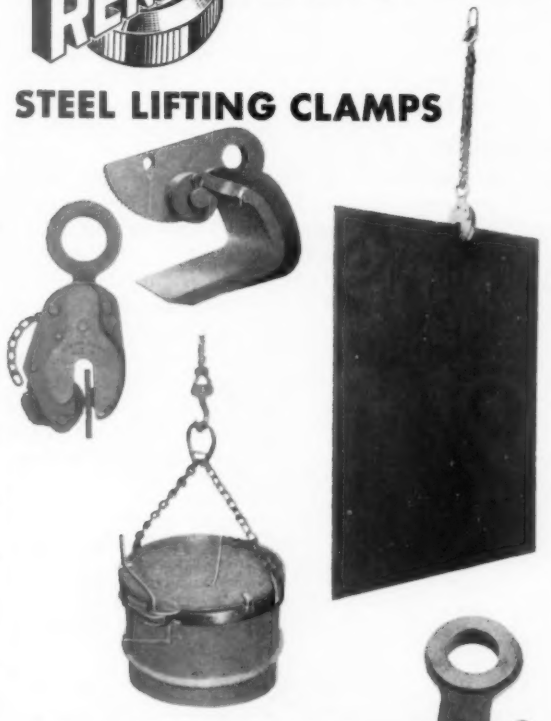
welds made without filler metal are generally concave on the arc side, convex on the root side. This is normally undesirable, but of no consequence if the weld is planished. Planishing lines up the sag so that crown and root are flush.

Another bonus the planished weld confers: Upgrading joint efficiency. In the missile cone comparison above, the cold-worked weld was rated at 100% joint efficiency, the unplanished weld at only 80% efficiency. To the designer this means a thinner material can be used or parts used to beef up the weldment can be eliminated.

FACTS AT YOUR FINGERTIPS: *Just circle the appropriate number on the Reader Service Card to get information on any of the products featured in this issue.*

RENFROE *Safety Snap Lock*

STEEL LIFTING CLAMPS



HANDLE STEEL WITH SAFETY

- √ Maximum Speed and Safety
- √ From ½ ton to 20 ton sizes
- √ Lock on in any position
- √ Lock off in any position
- √ Exceptionally light in weight
- √ The toughest clamp ever built
- √ Takes the place of welded pad eyes and screw clamps
- √ Cannot be accidentally knocked off
- √ Safety Factor 5 to 1

A Superior Line of Steel Lifting Clamps designed to meet today's demand for handling steel with maximum SAFETY and EFFICIENCY.

WRITE FOR COMPLETE CATALOGUE

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JACKSONVILLE, FLORIDA

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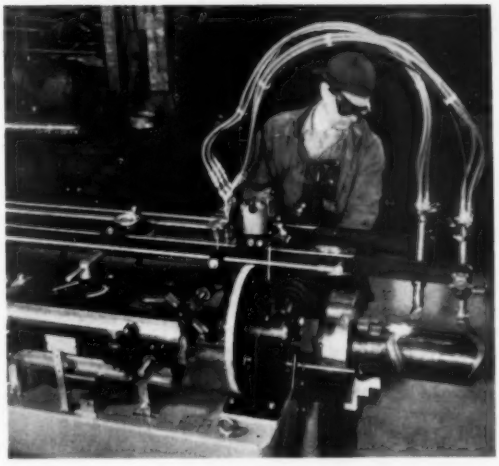
NOW CONTOUR PIPE WITHOUT CAMS OR TEMPLATES



"THE MECHANICAL DRAFTSMAN"

Now available in two standard models, this flame cutting machine contours pipe from 1½" to 24" diameter without cams or templates.

Makes mathematically precise cuts with no fitting required. Settings for any type cut can be made in only 15 seconds. Users report savings up to 75 percent over previous methods.

Floor-to-floor time for double end cuts (photo above) is only 3 MINUTES.

- Simple dimensional adjustments.
- Single lever control governs motor and cutting flames.
- Torches can be spaced up to three feet with standard machine.
- Stationary and portable types in both models.
- Variable speed drive.
- Three-jaw centering chuck.

"THE MECHANICAL HOLE CUTTER"

Flame cutting machine will cut circles and ellipses in flat plate, as well as perpendicular or angular holes in pipe or tank shells.
New mechanism maintains proper spacing between cutting tip and pipe automatically while cutting with no attention from operator after setting up.

STEFFAN ENGINEERING
SALEM, OHIO

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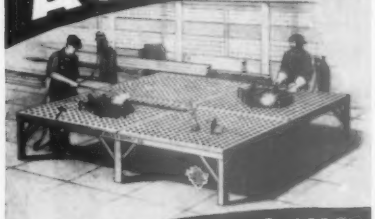
ACORN



BENDING BLOCKS
or
WELDING PLATENS

Semi-steel Blocks for layout, welding assembly work, etc., with machined working surfaces; also tools and accessories, including a full line of clamps, drift pins and dogging devices. Standard and special stands can be supplied. A 4-unit set-up, joined and mounted on stands, is shown above.

WRITE TODAY FOR LITERATURE

ACORN
IRON & SUPPLY CO.
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supplement the smaller multi-flame heads until the hard facing operation is well underway. The flames are usually directed at a point away from the area to be hard faced. This keeps the part at a uniform temperature throughout the entire mass.

Each of the three multi-flame heads used does a particular job. The first head preheats . . . it keeps the part at a uniform temperature. The second head brings the metal to a sweating temperature . . . ready to fuse with the molten alloy. The third head melts the rod. The amount of heat provided by each can be varied by blanking off any specified number of tips.

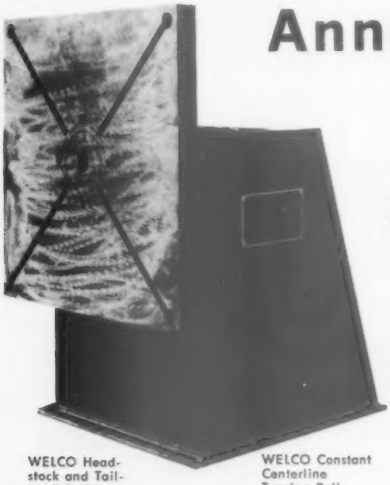
The heads and rod are held in a stationary position while the part to be surfaced rotates under them. The speed is adjusted so the groove will be filled in one pass. Multiple passes are avoided whenever possible. We feel these are more susceptible to cracking.

To insure a smooth deposit, the rod is moved back and forth along the width of the groove as the part rotates beneath it. This oscillating movement is created by a mechanism on the machine. It can be adjusted to assure a proper flow of the depositing alloy.

When the groove is completely filled with alloy, the rod is withdrawn slowly and the area between the start of the deposit and the finish is puddled to assure a homogeneous joint. Then the part is removed from the turntable. It is covered with an asbestos blanket and cooled slowly. • •

Based on a paper presented at the 1958 International Acetylene Association Convention.

We'll be looking for you at the National Metals Exposition. Stop in and meet the INDUSTRY & WELDING staff at Booth 2572 at the Public Auditorium, Cleveland, October 27-31. Guide to the Show; page 120.



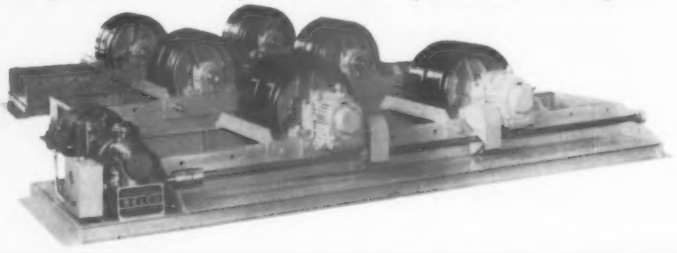
WELCO Head-stock and Tail-stock Positioners

WELCO Constant Centerline Turning Roll

Announcing "WELCO"

WELDING ENGINEERED TURNING ROLLS
AND HEAD AND TAILSTOCK POSITIONERS

WELCO offers the most complete line of automatic welding equipment in the industry today: Welco welding head manipulators, Circle Lock seam welders, positioners, portable back-up beams and special machinery.



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THE WORLD ELECTRIC COMPANY

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Weld with "WELCO"

Automatic Welding ARC WELCO RESISTANCE Specialists

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GB 88 FLUX .. *available in 3 oz., ½ lb., 1 lb., 5 lb. jars and 25 lb. drums to suit your needs*

Use GB 88 Flux, the flux of proven dependability and note the improvement in the quality of your Silver Brazing. GB 88 is fully active to 1650°F.

Low glare and low fuming characteristics insure operator comfort and quality results. It is stable in use as well as in storage and was developed for Silver Brazing of STEEL, BRASS, COPPER, STAINLESS STEEL, MONEL, NICKEL, INCONEL, CHROME ALLOYS, SILVER and GOLD.

For best results team up GB 88 Flux with GB Silver Brazing Alloy in the form or size you require: random coils (all diameters), strip, straight lengths, pre-formed rings and special shapes. Prompt service on all inquiries.

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GRAND SAFETY STANDARD
MANUFACTURERS SINCE 1921

SPEED CLAMPS

ASL CLAMPMASTER

Truly a "master clamp" — the last word in clamping convenience. Positions instantly by trigger action. Extra deep throats and extra strength. Screws, swivels and handles copper plated for protection against spatter. Rust proofed enameled handle. Alloy steel. 3500 lb. proof tested.

	No. 2 ASL	No. 4 ASL	No. 6 ASL	No. 8 ASL
Opening	2¾"	4¾"	6¾"	8¾"
Depth	4"	4¼"	4¾"	6"
Wt. Ea. Lbs.	2¾	4¾	6½	9
Price	$8.00	$11.25	$13.75	$17.50

QUIKCET BAR CLAMP

Made of alloy steel. Vise type, loose-proof handle. Spatter and rust proof. Extra quick action and durability make it first choice with welders everywhere. 15 inch opening capacity when used with standard (extra heavy duty) 12 inch bar. Extra bar extensions of any length available — .50 per ft.

WEIGHT 8 LBS. EACH **$18.50 ea.**

Write for FREE catalog.

GRAND SPECIALTIES CO.

3101 W. GRAND AVE.

CHICAGO 22, ILL.

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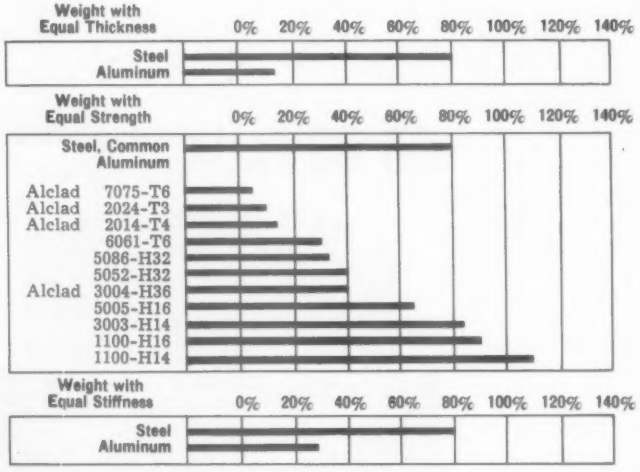
aluminum makes its bid on . . .



STRENGTH-TO-WEIGHT RATIO is based on an ultimate tensile strength of 60,000 psi for steel and the guaranteed ultimates for the various aluminum alloys; a flat 35 percent weight ratio for equal volume is used throughout.

ALLOY	Non-Industrial Atmosphere	Industrial Atmosphere	Marine Atmosphere or Sea Water
1100	A	B	B
3003	A	B	B
3004	A	B	B
5005	A	A	A
5050	A	A	A
5052	A	A	A
5086	A	A	A
6061-T4-T6	A	B	B
6063-T5	A	B	B
2024-T3	B	C	D
2014-T6	A	A	B
Alclad 2024-T3	A	A	B
7075-T6	B	C	D
Alclad 7075-T6	A	B	C
Utility Sheet	A	B	C

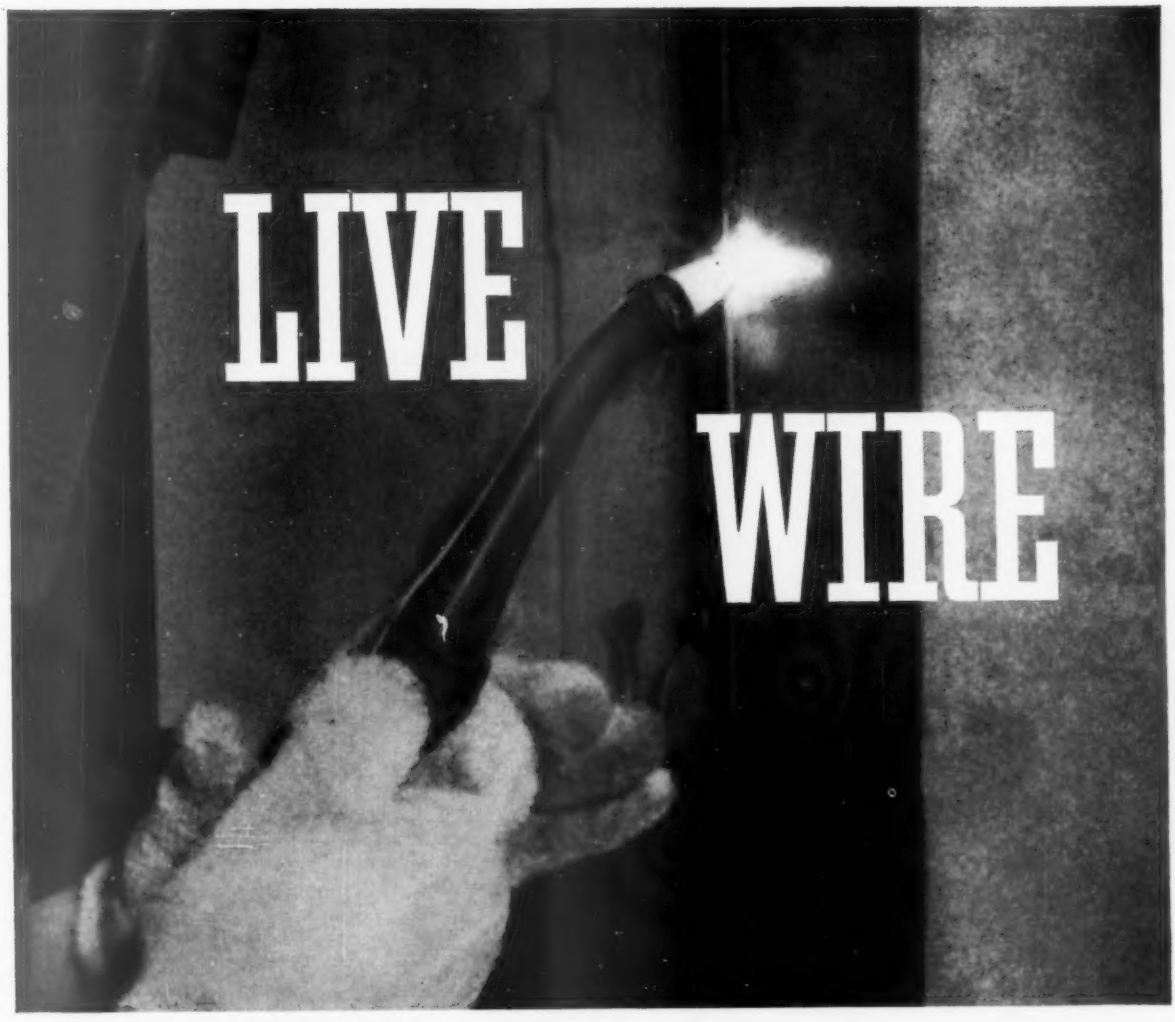
CORROSION-RESISTANCE of aluminum alloys is illustrated in relation to each other. A: best relative resistance; B: good relative resistance; C: fair relative resistance and D: not usually recommended without additional surface treatment.

The number of passes used ranged from one to 27. The latter were used on 1¾-inch butt welds. These were made out-of-position and would have been less if flat welding could have been done.

Semi-automatic welding was done at 12 to 18 ipm. Current settings were 180 to 260 amps with a voltage of 27 to 31. Shielding gas flow was 80 to 100 cfh.

Automatic welding was done at 22 ipm with 260 to 320 amps and a voltage of 27 to 28. Shielding gas flow was 100 to 135 cfh.

Tacking was done with semi-automatic equipment in vertical, flat or overhead position. In all some 700 feet of tacks were made. These ranged in size from 1½ to 2-inches long. • •



New design in Sigma hand welding torches

Here is a new, lightweight torch—only 16 ounces—for manually welding light-gage steels. Sigma ST-2 welds in all positions with no change in control or current settings. Welds .030- to .100-in. sheet, using low-voltage short-arc technique with .020- and .030-in. hard-drawn wire. For 200 amp continuous service, a-c or d-c.

Balanced design makes handling easy. Service lines enter through rear of handle—a convenience in cramped quarters. Start-stop switch on handle, easy to reach. Nozzle has a 60° curve for maximum weld visibility.

Sigma ST-2 makes high-quality welds at high speed. Seams require no cleaning . . . distortion is at a minimum. Inert gas shielding is economical. Low flow rate—only 10 cu. ft. or less per hour—means even more savings.

Call your nearest LINDE office today for a demonstration of this new Sigma ST-2 torch! Or write Dept. IW-10, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde
TRADE-MARK

UNION CARBIDE

"Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

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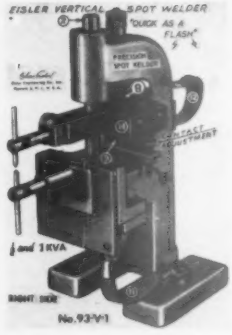
EISLER *makes the largest selection of spot, wire butt and foil welders . . .*



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. . . ALSO SPOT WELDING TIPS AND WELDING ACCESSORIES OF ALL TYPES

Eisler

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735 South 13th St. • Newark 3, New Jersey

Chas. Eisler, Jr.
President

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7 Styles to Choose From

WOOD OR STEEL HANDLES

TYPE A—Drift and Chisel. Wood handle, tool steel. Popular in malleable iron and grey iron foundries for general chipping. Also for cleaning torch cuts. Weight 20 oz.

TYPE CB — Triple Duty. Wood handle. Combines 3 tools in 1—drift, chisel, and removable wire brush. Weight 16 oz.

TYPE C—Drift and Chisel. Same as Type CB but without brush. Weight 14 oz.

TYPE E—Head made of high-grade ¾" square tool steel, steel handle combination drift and chisel. Special hand grip absorbs shock. Weight 16 oz.

TYPE EB — Identical to Type E except fitted with rugged replaceable cleaning brush. Weight 18 oz.

TYPE F—Similar to Type E, except head has two chisels at right angles. Weight 16 oz.

TYPE FB—Same as Type F except fitted with replaceable cleaning brush. Weight 18 oz.

ORDER FROM YOUR WELDING SUPPLY DEALER

CHICAGO MANUFACTURING & DISTRIBUTING COMPANY

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tion Engineering Department is surveying all weldments used in our excavators, mobile cranes and frontend loaders. These weldments contain from two to 200 different parts. Whenever a part is reordered — no matter what its size—we flame cut it, if at all possible. In fact, we think flame cutting is less costly even if we only cut two pieces at once.

We figure that when we flame cut all the parts we can, we'll save close to $20,000 a year.

Our main plant in Lorain, Ohio, uses six electronic-tracer multiple-torch flame cutting machines. That we are sold is no secret.

We cut out big pieces or make a large number of small pieces on our three 8-torch and three 4-torch machines.

One of the 8-torch machines takes plate up to 144-inches wide. The other two can cut plate to 100-inches wide. Two of the 4-torch machines are used on steel up to 80-inches wide. All five of these machines will handle plate up to 35-feet long.

Our third 4-torch machine is used on steel 48-inches wide and 10-feet long. It cuts small parts out of steel cut-offs salvaged from the larger machines.

In addition, we have a versatile single-torch straight-line cutting unit. We use it to bevel edges on bar ends.

Bevelling is also done in multiple quantities on the electronic tracers when long stripping operations are necessary.

We make further savings by using a white opaque plastic sheet for templates; this material readily takes a simple inked layout on it. Purchased in rolls, the plastic lends itself to simple storing and cataloging for future orders. It does not stretch or shrink with changes in atmospheric humidity.

We at Thew feel we will never reach the ultimate in flame cutting. New and better ideas present themselves with each improvement in equipment. The watchword is "Look to the so-called obvious for improvement." • •

WELDERS! SAVE MONEY!

on "tough" snagging & heavy duty industrial operations with the

VEE-ARC 2 H.P. PORTABLE GRINDER

This **NEW** grinder has the high productivity and low maintenance of air tools coupled with the high efficiency and versatility of electric tools. Design-engineered for use with **9"** disc wheels. Can be plugged into nearest 115-V. AC/DC power outlet . . . life-time lubricated . . . enusual warranty.

POWER . . .
PRECISION . . .
PERFORMANCE . . .

Mail Coupon NOW!

VEE-ARC CORPORATION Westboro, Mass., U.S.A.

Tell me more about this Vee-Arc Portable Grinder:

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Alloys and Fluxes for joining ALL METALS ALL METHODS

TORCH WELDING

ARC WELDING

TORCH BRAZING

FURNACE BRAZING

SOLDERING · FILLING · SEALING

GOOD WELDERS DO BETTER with these and other ADVANCED ALL-STATE ALLOYS

This trade-mark is reserved for the finest ALL-STATE has in FLUXES, FLUX-COATING, ALLOYS

ALL-STATE FLUX-COATED RODS HAVE ALL 3

Save Time! Money! Rework!

Nickel Silvers .... No. 11FC Brazing Rod
No. 13FC Buildup Rod

Bronzes ..... Flux-Coated, Low-Fuming Rod**
No. 41FC General Purpose Brazing Rod

Aluminum ..... No. 35FC Special Light-Coated Welding Rod
E-43 Electrode for Type 4043
E-2 Electrode for Type 1100

**This flux-coated, low-fuming bronze is typical of All-State flux-coated rods . . . speeds work by permitting operator's undivided attention to deposition and control. *Odor practically non-existent.* Flux coating is All-State formula of proven superiority and years-standing reputation for the rapid, positive, smooth cleansing action important to good brazing . . . is anhydrous . . . causes bronze to flow out more freely and smoothly.

NEW!
Instruction Manual covers whole line. Ask for FREE Copy

Distributor stocked everywhere! Convenient to buy! Economical to use!

Want your own bronze flux-coated? If you are committed to other alloys and need the economies inherent in having the flux on the rod, inquire! All-State's manufacturing subsidiary is available for **custom coating** with All-State Fluxes.

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

ALL-STATE'S NICKEL SILVERS

General Purpose! No. 11 can replace all conventional bronze, steel and cast iron brazing rods for torch application in both production and maintenance. It will join at least fourteen different metals satisfactorily. Also can replace —at substantial savings in cost—silver brazing alloys used in tool-tipping and hi-alloy tool steel repairs where base metal may be heated to 1750°F. Deposit from No. 11 has average tensile of 70-80,000 psi, shear 120-160,000 psi . . . machines easily.

General Purpose! No. 13 is for overlays on all surfaces requiring high resistance to frictional wear . . . is ideal for building up broken gear teeth, worn armature shafts, valve seats, worn bearings, etc. . . . has 10 to 14 times the wearability of ordinary steels. Deposits have an initial hardness of 110 Brinell . . . work harden to approximately 200 Brinell . . . become tougher with use.

Two-rod Supply! Both these nickel silvers have requisite wide utility to make them an ideal way to trim supply inventory downward . . . are easy-flowing . . . are easy to apply.

STRONG, TOUGH OR HARD

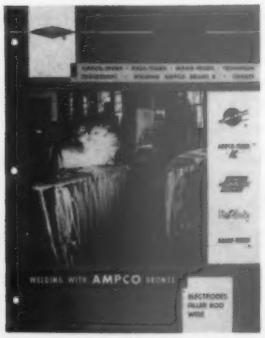
BRONZE WELD DEPOSITS

with AMPCO-TRODE® Bare 36" Filler Rods for the TIG Process

5 grades — hardnesses from 160 to 380 Brinell.

Sound, free-flowing deposits join copper-, iron-, and nickel-base metals and alloys; dissimilar metals and alloys. Used extensively to resist metal-to-metal wear and corrosion.

Ask your Ampco distributor to recommend the right rod for your overlay, fabrication, and repair applications.



AMPCO®

Write today for Bulletin W-17

AMPCO METAL, INC.

Dept. 176J, Milwaukee 46, Wisconsin

WEST COAST PLANT:
BURBANK, CALIFORNIA
SOUTHWEST PLANT:
GARLAND (DALLAS COUNTY), TEXAS

W-150A

Circle No. 41 on Reader Service Card.

HERE'S AN IDEA

photo courtesy Handy & Harman

Motorized Set-Up Speeds Fluxing of Flanged Parts

PRODUCTION ENGINEERS at Fenwal, Incorporated, manufacturers of precision thermostatic controls and fire detectors, have speeded up the fluxing of parts with awkward contours. Typical is the stainless steel aircraft fire detector shown above. This has a triangular flange mounted on a cylindrical shell.

The flux serves as a protective coating to prevent oxidizing of the stainless steel during subsequent torch brazing with AWS Specification B-Ag-1 alloy. The usual hand-brush method was too slow and tedious because of the awkward hand positions required to flux the upper and lower flange surfaces and the shell areas adjacent to the flange. Dipping was not practical because the assembly is open at the end.

Fenwal solved the problem with a motorized fixture. This holds the part in the horizontal plane and rotates it between a pair of flux brushes. The end of the shell is inserted in a collet mounted on the shaft of a fractional horsepower motor. This rotates at a speed low enough (45 rpm) to prevent centrifugal force from spraying off the flux. The collet ID is about ⅛-inch oversize to permit the shell to be slipped in and out freely. It is long enough to support the shell for about 2/3 of its length and prevent excessive sag or play during rotation.

The fluxing brushes are held in ends of a ¼-inch tube bent around to straddle the flange. The brush holder, which pivots freely on an axle, is slightly overweighed at the front end, so that the brushes dip into the flux trough when the operator releases the handle. In this way, the brushes swing out of the way when the fixture is being loaded and are always covered with flux and ready for use.

The fluxing rate with the set-up is about 8 seconds per piece.

Looking for a resistance-welding electrode not easily beat by **sustained heat?**

Order AMPCO-WELD® for your high-temperature applications.

Send for catalog, price list, and name of your distributor.

AMPCO®

AMPCO METAL, INC. DEPT. 177J, MILWAUKEE 46, WISCONSIN

WEST COAST PLANT: BURBANK, CALIFORNIA

SOUTHWEST PLANT: GARLAND (DALLAS COUNTY), TEXAS

RW-27

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REBUILD WORN TRACTOR SHOES

WITH BULLDOG GRIP LUGS

Bulldog Tractor Grip-Lugs can rebuild the grouser shoes of track-laying or crawler type equipment — at a fraction of the cost of new replacement parts. Equipment can be "relugged" without dismantling — saving hours of valuable downtime and labor.

Grip-Lugs are easily welded to the worn shoe. Made of special work-hardening steel they become tougher and harder with use —usually outwear the original grouser.

For all track-laying and crawler type equipment including Caterpillar, Allis-Chalmers, International Harvester, Oliver Cletrac, Euclid and other popular makes. In 10 foot lengths and 5 different sizes and shapes.

Write for Allied's special chart showing sizes and feet recommended for each tractor. Also "How-To-Weld" Grip-Lug grouser bars.

ALLIED

Sales Representative and Distributor Inquiries Invited

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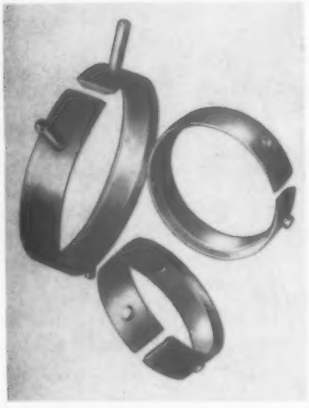
STEEL & TRACTOR PRODUCTS, INC.

7835 BROADWAY, CLEVELAND 5, OHIO, U.S.A.

APPROVED BACKING RINGS



FOR WELDING PIPE, VALVES AND FITTING JOINTS

- Time saving in fit up and handling.
- Consistent root penetration.
- Radiographic quality welds.

Available in Carbon Steel, Wrought Iron, Chrome Alloys, Stainless Steel and Aluminum.

Write for complete bulletin.

ROBVON BACKING RING CO.

675 GARDEN STREET • ELIZABETH, N. J.

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do double-duty at Visioneering: they fit-up as well as weld.

The next step is to power-file welds flush with the base metal. Then the frame is put into an angle iron squaring jig and clamped with about 75 "C" clamps. This assures a square frame after stress relieving.

Why stress relieve magnesium weldments? Squaring the frame, is one reason. But more important, welds would crack if left in the as-welded condition. Heat treatment allows heat-affected metal to deform plastically, thus relieving locked-up stresses.

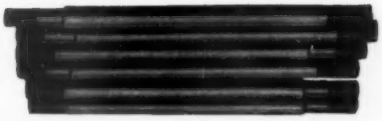
The final step is frame finishing and inspection. Truing up the frame is done by hand filing, an operation which takes about 7 hours, depending on the metallurgical condition of the magnesium. If hard spots caused by oxidation are met, the filing operation takes about 10 hours. During filing, an inspector continually checks for frame squareness and dimensions. When he is satisfied on this and weld quality too, he releases the frame to the skin assembly section.

Some press brake work is done on the skin door and drawer sheets. This is done in a 10 ton brake that handles up to 14 gauge sheet, and a long-bed brake of heavier tonnage for thicker material. All material is heated to 550°F before bending to prevent cracks. This operation takes one man at the furnace, two men shuttling, and one brake operator.

Final assembly includes mechanical fastening of skin and hardware, then painting. One prime coat and two coats of high quality enamel (baked) finishes the cabinet. For protection during shipment, the attractive unit is packed in a shock resistant material and crated. • •

FACTS AT YOUR FINGERTIPS: Do you want full information on the new welding products shown in this issue? Or do you want copies of the valuable free literature offered? Just circle the appropriate number on the bound-in Reader Service Card and mail it. Our Reader Service Department will see that your requests get sent on their way promptly.

Pump rods hard-faced by ThermoSpray Process give 20 times longer service



New Metco Process hard-faced acid sludge pump rods serve as much as 20 times longer than unfaced rods.

A number of oil companies are making important savings in equipment down-time and replacement part costs with the METCO THERMOSPRAY® Hard-Facing Process. Typical of these parts are pump sleeves, as well as the acid sludge pump piston and rods shown here. Operating conditions were severe—rods had to be replaced every 24 hours—new packing every 8 hours. Hard-faced rods now last over 500 hours; packing more than 60 hours. Coatings are extremely dense and non-porous—homogeneous.

The THERMOSPRAY Hard-Facing Process consists of spraying specially developed alloys in powder form with the METCO THERMOSPRAY GUN. No compressed air is required. Coatings have hardness of Rc 30 to Rc 65, depending on the specific THERMOSPRAY alloy used; will outwear hardened steels from 3 to 10 times. Spraying speeds are higher—8 to 10 lbs. per hour—and deposit efficiency far greater (up to 97%)—than with any other type of available equipment. Hard surface depth can be closely controlled and the smooth surface left after spraying requires a minimum of finishing.

Write today for free descriptive Bulletin 126A or a call by a full-time, company-trained, Metco Field Engineer in your territory. Or see your local metallizing job shop.

The following trade names are the property of Metallizing Engineering Co., Inc.: METCO®, ThermoSpray.
®Reg. U.S. Pat. Off.

Metallizing Engineering Co., Inc.
1179 Prospect Ave., Westbury, L. I., New York • cable: METCO
In Great Britain: Telephone: EDGEWOOD 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

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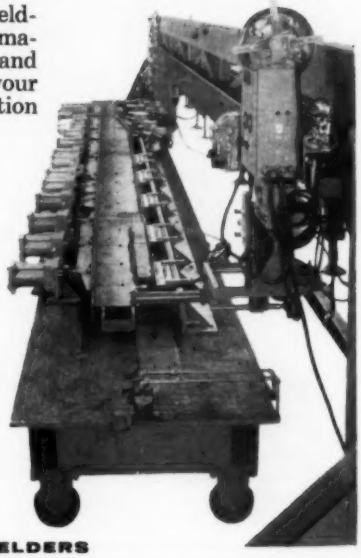
GOODRICH WELDING

Machines Transformers Automation

ARC WELDERS

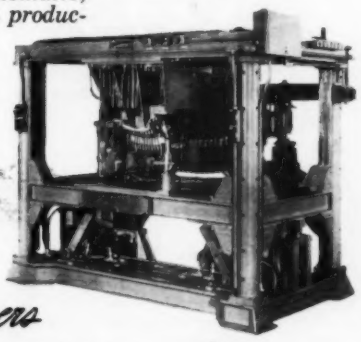
Automatic arc welding fixtures and machines designed and built to match your part and production requirements.



RESISTANCE WELDERS

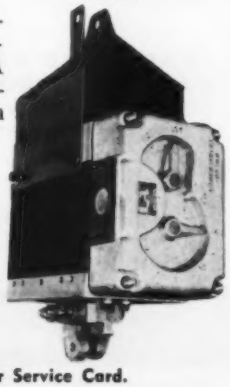
Resistance welding machines and fixtures for your requirements *from single spot to automatic, multiple operation production lines.*

AUTOMATION
Moving and loading devices a specialty



Transformers

Standard fixture and Gun-Type resistance welding transformers in 10 to 500 KVA ratings, or to your specifications. Over 30,000 now in operation.



Write for Literature
GOODRICH
WELDING EQUIPMENT CORPORATION
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Now! THE NEW INEXPENSIVE WAY TO SOLVE YOUR SEVERE ABRASION PROBLEMS!

SS HC HARD PLATE

Heat Treated High Carbon Steel

- Brinell hardness 230/250.
- Tensile strength 110,000 psi.
- Easily welded with L. H. electrodes.
- Machinable with high-speed tools.
- Easily fabricated in the field.
- Lasts from 3 to 10 times longer than mild steel.

APPLICATIONS: • Chutes • Hoppers • Spouts • Truck Beds • Buckets • Conveyors • Loaders • Scraper Blades • Screens, etc.

SEE YOUR WELDING SUPPLY DISTRIBUTOR — HE'S A GOOD MAN TO KNOW.

WRITE FOR COMPLETE DETAILS AND NEAREST DISTRIBUTOR

PRODUCT OF STULZ-SICKLES CO

929 JULIA ST. • ELIZABETH, N. J.

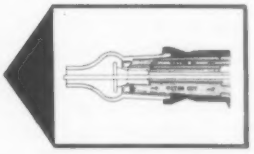
NOTHING EVEN COMES CLOSE TO THE AMAZING TEC VISUWELD TORCH

ALL THESE FEATURES IN *ONE* TIG TORCH!

THE *ORIGINAL* VISUWELD TRANSPARENT GAS NOZZLE!
An unrestricted view of the weld while welding with durable fog-free Quartz, Yycor or Pyrex nozzles.

GUARANTEED GAS AND WATER LEAKPROOF!
One-piece unit torch head. NO fittings or gaskets. NO gas or water escapes.

LIGHTEST WEIGHT TORCH...ONLY 3 OUNCES!
Three ounces of working weight means easy, faster handling.



EXCLUSIVE "TIP-OF-TORCH" COOLING FOR COOLER OPERATION!
Tec's design flows cooling water to "tip-of-the-torch." NO cooling off time even at 350 amps.

3 TORCHES IN ONE!...
Weld efficiently, continuously from 3 to 350 Amps. . . . AC or DC. No need to change torches.

Write NOW for full information on the TEC Visuweld Torch and Other Superior Visuweld Equipment

TEC TORCH CO., INC. 300 PATERSON AVENUE CARLSTADT, NEW JERSEY

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able flux were used. Welding was done at 350 amperes and 28 volts.

All craters in the root pass and in passes adjacent to the groove face were ground with aluminum oxide or silicon carbide wheels (rubber or resin-bonded—36 or 30 grit) not used on anything other than austenitic stainless. Same wheels were used on subsequent grinding operations.

Slag and weld spatter were carefully removed from each pass before going on to the next. This was done with slag hammer, chisel and by wire brushing with a stainless brush. Peening wasn't permitted.

No preheat was needed. However, if weldment temperature had dropped below 60°F, it would have been preheated to 60°-85°F. Interpass temperature was kept below 250°F.

Dye penetrant and radiographic inspections were made at intervals during welding.

After welding they ground weld surfaces flush and made x-ray examinations.

Completed pipe sections were then mechanically sized. Heating and cooling was the same as in forming.

Sizing is a sort of hot working; it's done at 1800°-2100°F. The grain structure of stainless welds is columnar and usually coarse. Sizing breaks it up to some extent, makes it more like the parent metal. After sizing the weld is air-cooled and inspected again. This time the dye penetrant process is used.

Pipe sections were then blasted with angular silicon carbide grit to clean surfaces before heat treating. This was done by heating section to 1900°-1950°F in a natural gas-fired furnace and a slightly oxidizing atmosphere, holding for one hour per inch of wall thickness and quenching in water.

Again more tests were made, this time chemically: intergranular corrosion tests, microscopic examination and chemical analysis. Tests were made for each heat.

continued on next page

TOUGH

protection

EUTECBOR 9

EXTENDS LIFE

OF EXPENSIVE

DRILLING TOOL

HARD ALLOY OVERLAYS PUT "TEETH" IN ROCK BITS

High cost of oil drilling bits demand that tool life be extended. **EutecBor 9** has proven perfect for the job... permits repair and renewal of rock, core, hole, reaming and fish tail bits, as well as casing scrapers, reamers, and similar tools.

EutecBor 9 offers the utmost in heat, corrosion, wear resistance at normal or elevated temperatures, features low application temperatures 1800° to 1900°F. Mirror smooth, longer lasting deposits, RC 55-62, are obtained without danger of penetration or undercutting.

EutecBor 9 is only one of **150 "Eutectic Low Temperature Welding Alloys"®**. See your **local "Eutectic" Technical Representative** for further information-on-the-job assistance in any welding problem.

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Dallas	Riverside 1-5829
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Los Angeles	ANgelus 8-3451-2
Phoenix	ALpine 3-0900
St. Louis	GEneva 6-4644
Montreal	RAymond 1-4930, 1-4939
Dartmouth, Nova Scotia	6-2159

Plant, Research Laboratory and World Headquarters

Low Temperature EUTECTIC WELDING ALLOYS

®Registered Trademark of:

EUTECTIC WELDING ALLOYS CORPORATION

40-40 172nd Street, Flushing 58, New York, N.Y.

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Next step was machining the inside diameter of the pipe—and the outside.

Another test? Of course! This time hydrostatic, at 3940 psi.

Then the various mechanical tests were made on 5-inch cut offs. The pipe sections are made that much longer so cut-offs can be subjected to flattening and reverse bend tests and tension tests.

Final machining brought pipe to finished dimensions: 7.177 inch I.D. (plus .031, minus .000); 8.625 inch O.D. (plus .062, minus .031). Maximum eccentricity was .030/.028 through center section.

Internal surfaces had final finish of 250 micro-inches.

Then another round of inspection. First, all pipe sections were examined completely on the outside using the dye penetrant method. The same method was used to check as much of the inside as possible.

Radiographic inspection with a 250 KV X-ray unit completed inspection. Radiographs were interpreted to unusually stringent specifications. • •

Applications: Aircraft fuel preheaters are a good example.

One particular type had to resist corrosion and high internal pressure. Instead of using the heavier all-steel construction, a composite structure was made from a stainless core and an external shield of aluminum. The new preheater met all requirements and weighed 30 percent less. The weight saving was made possible by the aluminum shield and the use of aluminum valves and plumbing which were welded to it.

The process makes possible the use of a lighter-weight aluminum core with a stronger, more fire-resistant external stainless shield. • •

FACTS AT YOUR FINGERTIPS: *Just circle the appropriate number on the Reader Service Card to get information on any of the products featured in this issue.*

CRACKED STEEL?

EUTECTIC

STEEL ALLOYS

PROVIDE

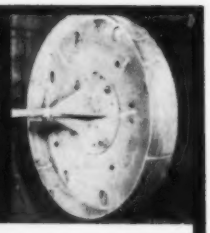
TOUGH

DEPENDABLE

WELDS

EVERY TIME

5 MONTHS "DOWN TIME" SAVED... COST CUT 66%



This pulverizer intermediary ring cracked in operation. Replacement was costly—would keep the pulverizer shut down for 5 months. Despite the ring's high speed of rotation, and the heavy punishment it receives in operation, it was decided to try welding the cracks. Made of a special alloy steel, cutting out the cracks was a problem in itself. **"ChamferTrode"** effected the rapid removal of unwanted metal in the area to be welded. **EutecTrode 680 AC-DC** with "Frigid Arc" coating was used for the filling operation. An extra high strength (120,000 psi) low amp electrode, it allows smooth, dense, non-porous deposits.

Repaired and back in operation, the ring has operated continuously with no further break-down. Materials were less than 1/5 replacement cost—Down time, less than 3 days.

For information, and expert aid on any welding problem see your **local "Eutectic" Technical Representative.**

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NEW PRODUCTS

Most Powerful Expander Develops 1580 Tons of Force

A new metal working machine that develops more than 1580 tons force to true and size metal rings cold, has been announced by the Grotnes Machine Works. The 40-H-1580 Hydraulic Expander has replaceable dies for stretch-forming a variety of ring diameters in lengths up to 28 inches. Expanding 2-inch thick steel rings (46,000 psi yield strength) to within plus or minus .010" accuracy on the diam. is duck soup for the new machine. Other advantages: Costly machining to obtain part roundness is eliminated, and part can be one-inch out-of-round before expansion.

Circle No. 160 on Reader Service Card.

Safety Flow Indicator

The McIntosh Equipment Corporation has announced a new fluid flow safety signal which indicates at a glance whether flow is taking place.

The unit can be placed in any water or oil circulating system. Examples: cooling water for welding equipment, air compressors, and cooling oil for transformers.

This unit comes in different models, and can be set at high and low ranges in the field.

Circle No. 163 on Reader Service Card.

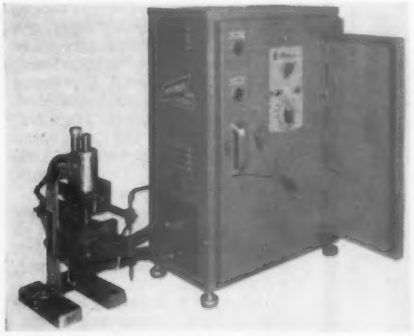
Stored Power Cuts Costs

A new sequence interlock made by Instrument Control Company permits the operation of a group of spot welders from a power line capable of handling only the largest unit.

The control system locks any welder to the line during the firing cycle and prevents other welders from being fired at the same time. It electrically scans the other welders until it finds a unit ready to fire.

Control operation is so fast that there is no delay in welder firing. Production is always peak. Its rigid control can save on power costs subject to demand rates.

Circle No. 164 on Reader Service Card.



Circle No. 161 on Reader Service Card.

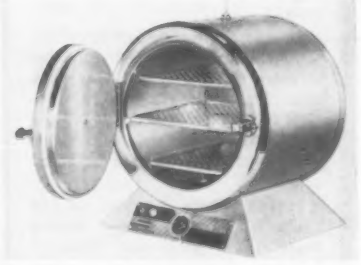
Circle No. 162 on Reader Service Card.

AC and DC Power Supply Units

Hoffman-Chicago has introduced two new lines: AC power supply units (left) and DC stored energy power supply units (right). Both are packaged in ventilated steel cabinets.

The AC units are available in 1.5, 3.5 and 5 KVA sizes. They are complete with 10E synchronous timer with tapped ½ to 10 cycle adjustment; also four steps of heat on the auto transformer plus a phase shift heat control. Supply voltages can be 115, 208, 230, 440 or 550 volts. These units are said to be readily attached to any bench welder.

The DC units are available in 300, 600 and 1250 watt seconds sizes. Units are complete with capacitor selector switches and infinite voltage adjustment dial mounted on an instrument panel. An outstanding feature is the automatic electronically controlled charging voltage with a positive hold-off of discharge until present voltage is reached. A separate unit welding transformer is designed for mounting on top or under a bench. Units are readily attached to any make of foot- or air-operated bench welding head.



All-Purpose Heating Oven

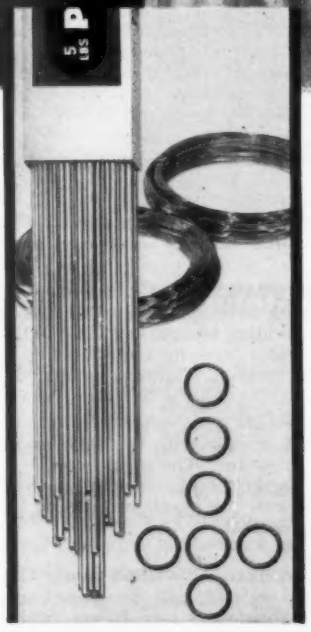
"Circ-O-Therm" is the name of a new (multi-use) oven being produced by the Hevi-Duty Electric Company. Its design features assures uniform heat throughout the working chamber with no cold corners and no hot spots. Typical applications: preheating, heat treatment, dry heating of coated electrodes and soft soldering.

The oven operates on either 115 or 230 volts A.C. A power selector switch on the front panel regulates high and low input to the heating elements. Temperature is controlled by a sensitive bulb type thermostat, operated by a knob on the panel. A pilot light indicates when the power is on.

Circle No. 165 on Reader Service Card.

more new products on page 102

the meaning of custom-made quality brazing alloys



In coils, straight lengths, or preformed rings, Phoson and Sil-Bond brazing alloys are available through welding supply dealers everywhere in the United States.

Scientific COLOR analysis keys quality control of United Phoson and Sil-bond brazing alloys

Brazing results depend upon alloy uniformity ... that's why United scientifically controls this vital factor through the modern miracle of *spectrographic analysis*. Skilled technicians *arc test* United Phoson and Sil-Bond alloys. This sets up a color spectrum which is analyzed by ultramodern, spectrographic equipment ... and results in the most positive alloy check ever developed!

Spectrographic control coupled with United's continuous casting production processes are the reasons why Phoson and Sil-Bond alloys assure uniform results, speed up production and reduce finishing requirements.

A colorful new 8-page booklet, "Low Temperature Brazing Engineering Facts and Data" is packed with valuable information which you need for more profitable brazing. A copy is yours free. Write, wire or phone, today.

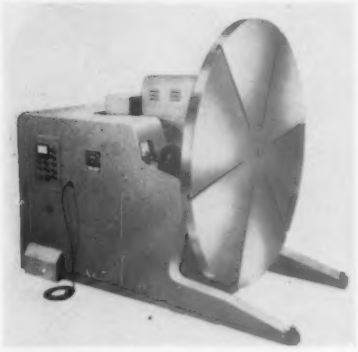
UNITED WIRE AND SUPPLY CORPORATION
1497 Elmwood Avenue, Providence, Rhode Island

Permanently United

Specify **UNITED** *for brazing alloys ... aluminum, brass, copper tube and wire*

PLAN TO VISIT BOOTH 1142 AT CLEVELAND METAL SHOW, OCTOBER 27th-31st

Circle No. 107 on Reader Service Card.



Precision Positioner

The Weldma Company developed its Model SA 40-P-1 positioner to meet a need for precise control and positioning of complicated weldments made from titanium and other super alloys. Assemblies weighing up to 4000 lbs. can be positioned in seconds.

Rotation for circumferential welding is done smoothly and with constant vibration-free power at exact predetermined speeds. Power is transmitted through hardened and ground steel worm and bronze worm wheel drive.

Circle No. 114 on Reader Service Card.

Handyman-Size Packages

Handy & Harman has developed a special package for their Sil-Fos and Easy-Flo 45 silver brazing alloys, for users who have but once-in-a-while need. Sil-Fos (nonferrous brazing), comes 20 20-inch sticks to the carton; Easy-Flo 45, (ferrous brazing), comes 17 20-inch wires to the carton. Brazing instructions are included.

Circle No. 166 on Reader Service Card.

DC Arc Welding Machines

Three new machines for plant and field use have been announced by Air Reduction Sales Company. The new models: Aircomatic Fillerarc (See Photo) designed for consumable-electrode, gas shielded welding; two Hornet 36B motor generators for both metal arc and inert arc welding; and two Yellow Jacket water-cooled engine driven welders for field service. Models come in current ratings to handle any job.

Circle No. 167 on Reader Service Card.

Hot Applications

A new nickel-base brazing alloy containing chromium and phosphorous for high-temperature service has been announced by The Stainless Processing Div., Wall Colmonoy Corp. Nicrobraz 50 is recommended for applications where high strength, minimum penetration of alloy into base metal and low neutron absorption is required. Alloy flows free, has good oxidation resistance to 1575°F. and comes in several forms for furnace or torch brazing.

Circle No. 168 on Reader Service Card.

Fabrication Aids

Two new accessories, introduced by Acorn Iron & Supply Company for use with their Welding Platens or Bending Blocks are available. They are: A Bending Post and a Horizontal Clamp. Both products have many clamping and bending uses.

Circle No. 169 on Reader Service Card.

Air Cooled Holder

A new high current, heavy duty air cooled electrode holder capable of handling very high welding currents and high duty cycles on metallic arc welding, has been announced by J. B. Nottingham Company. The lightweight, compact holder is kept at a comfortable operating temperature with a low air pressure cooling system.

Circle No. 80 on Reader Service Card.

NEW PRODUCT BRIEFS

REMOVE STAINS AND BURNS made by welding stainless steel with a acidic liquid developed for the purpose by Chemclean Products Corporation. The stain remover has been found effective on the 300 series stainless steels. **Circle No. 170 on Reader Service Card.**

A NON-CORROSIVE LIQUID FLUX has been developed by Eutectic Welding Alloys Corp., for soldering copper and tinned metals. Eutec-Sol Neutral Flux No. 808 is used with solders melting below 500°F, for radio, television and electronic work. Flameless (best) or indirect open flame heating can be used. **Circle No. 171 on Reader Service Card.**

SAFER DYE PENETRANT INSPECTION has resulted with Magnaflux Corporation's development of new Spotcheck dye penetrant inspection materials with nonflammable or very-high-flash-point formulas. Cleaners and developers contain safer chlorinated hydrocarbons; penetrants have chlorine-free ingredients. **Circle No. 172 on Reader Service Card.**

HIGH STRENGTH GRINDING WHEELS, BR Depressed Center types are a quick-mounting, safe-working development of Chicago Wheel and Mfg., for use on all types of disc grinding equipment. Key to the extra strength and safety are: A metal center-bushing and two-side resin reinforced fabric. Wheels take rough, tough production weld grinding. **Circle No. 173 on Reader Service Card.**

CERAMIC-TO-METAL BRAZING is easy with the new special purpose wire developed by Little Falls Alloy Inc. The nickel coated titanium wire is used to seal ceramic base vacuum tubes. Available in .062 to .004-inch diameters, the alloy bonds with the ceramic, forming an air-tight seal. **Circle No. 174 on Reader Service Card.**

RESTORE BREAKS IN GALVANIZED COATINGS with Galvanox, a new brush-applied paint high in metallic zinc developed by Subox, Inc. A five-mil thick coating of Galvanox is said to conform to ASTM specs for hot dip galvanizing; adherence improves with age. **Circle No. 175 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *Do you want full information on the latest welding products shown on these pages? Just circle the appropriate number on the bound-in readers service card and you'll get it.*

Circle No. 47 on Reader Service Card.→

FULL-LOAD TESTED!

Only G-E Ignitrons Come PROVED for Welding Service!

General Electric is the only builder of ignitrons to use test equipment which fully proves tubes under actual welding conditions. Tests are made at voltages and currents exceeding maximum requirements.

Occupying over 3,100 cubic feet of area, General Electric's extensive test equipment probes for—and rejects—any operating faults which might affect the performance of G-E ignitrons in your plant, such as improper ignitor firing, tube arc-backs, etc.

Here is unexcelled protection for your dollar investment in ignitrons! Here is the best possible assurance that your welder downtime will be kept low—that production will remain high.

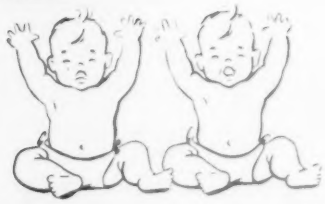
Install General Electric *full-load-tested* ignitrons! Made in the widest range of sizes and types. Fully competitive in price . . . stocked by a G-E tube distributor who is near you. Phone him! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Kentucky.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

11-12-102

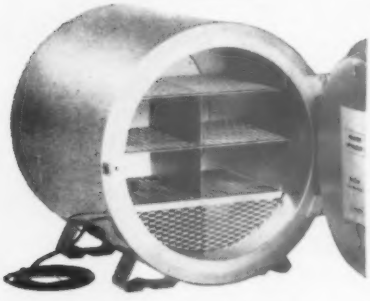
YOU GOTTA KEEP 'EM DRY!



Moisture "messes up" electrodes, too, cuts welding profits.

End costly reworks by drying rods in

DryRod® OVEN



Mineral coated electrodes are *thirsty*. The instant you unpack them they start soaking up moisture . . . within 2 hours often as much as 13 times US allowable specifications. Moist rods cause porosity, under-bead cracking, rough welds, etc. Rod scrap runs high. Production slows down. Reworks eat up profits.

Storing rods in DRY-ROD OVEN prevents such losses, insures faster, finer workmanship at less cost.

Write for new literature on latest rod-drying methods. "Dry Rod as Standard Welding Equipment."

PHOENIX PRODUCTS COMPANY

4731 N. 27th St. • Milwaukee 9, Wis.

Circle No. 82 on Reader Service Card.

Combination Welder

A new combination AC-DC transformer-rectifier welder, the Miller 180 Twin, has been announced by Miller Electric Mfg. Co., Inc. Unit delivers two AC ranges: 20-115 and 60-180; one DC range, 40-150 amps.
Circle No. 176 on Reader Service Card.

Powdered Iron Electrode

The Lincoln Electric Company has announced a new E-6012 electrode designed to reduce the cost of production and maintenance welding. The electrode is classed as an all-position AC and DC mild steel type and is said to give good bead appearance with easy operation, reduced spatter and easy slag removal. It is available in 1/8, 5/32 and 3/16-inch sizes.
Circle No. 177 on Reader Service Card.

Flexible Mask Goggle

Greater area protection and better facial fit are features of a new improved flexible mask goggle announced by American Optical Co. The new mask fits anyone and over any safety Rx glasses. Its impact-resistant lens, easily removed and replaced, gives more vision, better flying particle protection with either clear or green lens.
Circle No. 178 on Reader Service Card.

Build-up Electrode

The Stoody Company has announced a new electrode for manual build-up called Build-Up (Iron Powdered Coating).

It is designed to add vital properties with balanced alloys that will produce good quality deposits on carbon and low alloy steels.

The new electrode is said to deposit better than 6 pounds per hour at 250 amps current. It operates on AC or DC (either polarity) with good weldability and efficiency and low spatter loss.
Circle No. 179 on Reader Service Card.

12 Ton Power Punch Press

The Alva Allen Industries has designed a new 12 ton tilting press. Frame is of high quality grey iron. Clutch is of single pin, knife type design with all contact parts hardened for long wearing life.

The press is available in bench or floor model type.
Circle No. 180 on Reader Service Card.

Portable Fume Exhauster

A new stand type, caster mounted fume exhauster, the W-200-50, capable of moving more than 800 cubic feet per minute at any fume site, has been announced by Engwald Corporation. The gasoline or electrically driven blowers have an 8-foot stainless steel hose assembly including arms and counterbalance for universal positioning.
Circle No. 181 on Reader Service Card.

AC-DC Voltmeter

Designed for quick measurement of voltages up to 600 is the palm-sized Model UV-1 Voltmeter introduced by Columbia Electric Mfg. Co. Unit is made of durable molded plastic and weighs nine ounces. With the connection of voltage leads, one of four ranges can be selected with a rotary switch. Unit accuracy is 2% on DC, 3% on AC.
Circle No. 182 on Reader Service Card.

A New Abrasive Paper

A new coated abrasive finishing paper has been developed by the Armour Coated Abrasives Division, Armour and Company. The new No-Load paper requires no water lubrication, nor downward pressure to get good finishes.

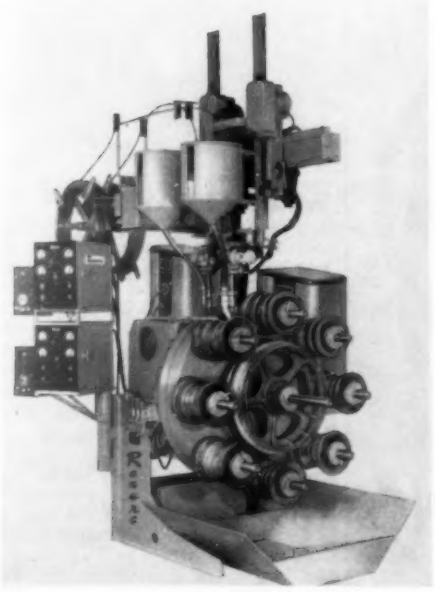
The coated abrasive prevents residue from clogging the grains, resulting in a longer lasting product, that cuts faster and better.

No-Load can be used on ferrous and non-ferrous metals, wood, plastics, ivory, and ceramics.
Circle No. 183 on Reader Service Card.

more new products on page 106

Circle No. 91 on Reader Service Card.

Revolutionary *Rexarc* Enables High Speed Production in Tractor Roller Rebuilding



Here is the new *Rexarc* MS-8 Automatic Twin Head Roller and Idler Welder and Positioner that revolutionizes roller rebuilding. One operator can do as much high quality work as three to four men with other types of equipment.

•

Mounts 8 rollers at a time. Hydraulic indexing enables virtually a continuous automatic welding operation. Twin heads build up both sides of roller simultaneously.

•

Factory engineer trains your operator, assuring excellent results from the very beginning of welding operations, at no additional cost.

•

Write, wire or phone today for complete information about this revolutionary profit-maker.

Manufactured by

THE SIGHT FEED GENERATOR COMPANY

SALES OFFICES AND FACTORY, WEST ALEXANDRIA, OHIO, U.S.A.

"Our hammer mill proved it—

Only Colmonoy No. 1 hard-facing lasts so long, costs so little!"

Colmonoy No. 1 hard-facing stands up under rough conditions involving impact and abrasion. Its cost is moderate and it welds easily. Great on equipment like dozer blades, shovel teeth, crusher rolls, and conveyor parts.

The new low-hydrogen coating provides excellent arc stability and makes weld cleaning between successive passes unnecessary. You can use it on vertical surfaces, too. Colmonoy No. 1 deposits are hard: 58 to 63 Rockwell C.

Write today for more information about Colmonoy No. 1 and the rest of the Colmonoy line of hard-facing alloys.

HARD-FACING ALLOYS

19345 JOHN R. STREET **WALL COLMONOY** DETROIT 3, MICHIGAN

CORPORATION

BIRMINGHAM • BUFFALO • CHICAGO • HOUSTON • LOS ANGELES
MORRISVILLE, PA. • NEW YORK • PITTSBURGH • MONTREAL • GREAT BRITAIN

Available as 1/8, 3/16, and 1/4-inch diameter electrodes (DC), in 10 and 50 lb. metal containers.

Circle No. 112 on Reader Service Card.

Circle No. 80 on Reader Service Card.

Is your holder too hot to handle? Then the **NEW**

Nottingham Air-Cooled Holder is for you!

INCREASE PRODUCTION
INCREASE ARC TIME
LOWER MAINTENANCE
REDUCE OPERATOR FATIGUE
LONGER HOLDER LIFE

This new Nottingham air-cooled electrode holder is specifically designed for high welding currents and high duty cycles. Large electrodes, thru 5/16 can now be used at maximum current on high production work.

Positive Cooling of the holder and cable whip is provided by a low pressure air system. The Air Cooled Holder features lighter weight and greater maneuverability for maximum operator comfort and increased efficiency.

The holder features an operator controlled air control valve and a rubber molded Cam-Lok connector.

May we send you detailed information?

J. B. NOTTINGHAM & CO. INC.

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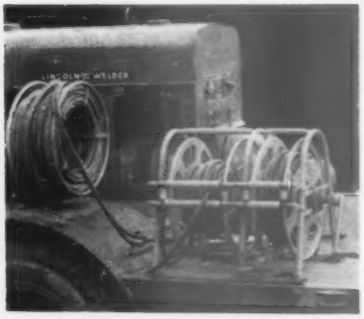
7114 FRERET STREET	3186 NORTH 18TH STREET	4955 W. FOND DU LAC AVE	1965 PACIFIC AVENUE
NEW ORLEANS 18, LA.	ARLINGTON VA.	MILWAUKEE 16, WISC.	LONG BEACH 6, CALIF.
UNIVERSITY 1-9360	JACKSON 5-9243	HILLTOP 4-8180	HEMLOCK 5-2522

HEAVY DUTY REELS

SAVE CABLE—SAVE HOSE



For SHOP or PORTABLE USE

Portable mounting (shown above) of our A-8 Oxy-Acetylene hose reel and Model EW-2 Electric Cable Twin-Reel, form the perfect combination for economical, efficient and safe welding. Built sturdy and guaranteed against defective workmanship these reels will increase the life of your hose and cable. Model A-8 Oxy-Acetylene hose reel, 150', ¼" twin capacity—$39.50. Model EW-2 Electric Cable, "Twin Reel" 250' electrode . . . 125' ground, 1/0 cable capacity—$125.00.

BERNARD MACHINE MFG. CO.

Route 4, Salem, Va.

Manufacturers of water reels also.

Circle No. 28 on Reader Service Card.

WOOD HANDLE OR STEEL HANDLE—
Atlas Gives You The Best!

For welders who prefer wood handle Tomahawks, Atlas W-H models are tops. "Tough" induction hardened heads, long, thin chipping blades assure maximum life.

Write for Atlas Catalog.

Atlas Welding Accessories Inc.
707 E. Lewiston Ave. • Ferndale 20 (Detroit) Mich.

Circle No. 22 on Reader Service Card.

Welder: DC Welding

A new combination DC arc welder and AC power unit for running tools and lights during welding, has been introduced by Hobart Brothers Company. Called Powr-Weld, generator, driven by 4 cycle, 2 cylinder, air-cooled engine, is rated at 200 amps, at 25 volts, on 100% duty cycle, for straight or reverse polarity welding. Same generator provides full 5 KW, 110/220 volt, single phase, 60 cycle AC Power.

Circle No. 184 on Reader Service Card.

Copper Coated Wire

Developed for welding the AISI-1025 to 1045 steels is Page A-S-18 welding wire announced by Page Steel & Wire Div., American Chain & Cable Co., Inc. Properties like 81,000 psi tensile, 61,000 psi yield and 24% elongation, are obtainable for CO_2 or submerged arc welding of .35 carbon steel.

In addition, the new wire will deposit strong and non-porous welds in the 1100 free-machining series.

Circle No. 185 on Reader Service Card.

Low-Cost Gas Outfit

A new Purox W-200 Starter Set has been introduced by Linde Company, Division of Union Carbide Corp. The set includes a blowpipe with one welding head, a cutting attachment and a cutting nozzle, two regulators, hose, goggles and a friction lighter. An enameled steel carrying case is furnished.

The welding head furnished with this outfit welds up to ⅛-inch thicknesses. The cutting attachment and nozzle cut up to 2-inches.

Circle No. 67 on Reader Service Card.

more new products on page 108

FOR

HARD SURFACING

USE

HARD-N-TUFF

The STEEL HARDENING COMPOUND that makes TOOLS and PARTS LAST 300% LONGER!

HARD-N-TUFF is used by leading firms in every industry for tough hard-surfacing problems because of these proven advantages:

- Works on any kind of steel, cast iron, or iron-base powdered metals.
- No special equipment required—treat tools in your own shop.
- Entire application takes only 5 to 10 minutes.
- Nitrides, carburizes and chromizes in one simple operation.
- Produces file-hard case with tough inner core.
- Makes mild steel outwear tool steel.
- Creates no distortion or change in dimensions.
- Safe—contains no caustic ingredients.

Prior to being treated with HARD-N-TUFF, this high-speed drill could make only one hole through chrome and nickel casting 17/32" thick, before being redressed. After HARD-N-TUFF treatment, this same high-carbon drill was used 20 times, without redressing, for the same job.

These untreated spur gears lasted only about 1 month before wearing out. Now the gears, after treatment with HARD-N-TUFF, last at least 6 months.

Chisel made from ordinary 1020-1/2" drillrod, hardened with HARD-N-TUFF, cut rust-locked nut with 2 hammer blows. Cutting edge was completely undamaged.

Write for FACT SHEET

that lists unlimited applications; shows how easy HARD-N-TUFF is to use; gives a partial list of firms now using HARD-N-TUFF to cut costs and increase production; complete price list and packaging details.

HARD-N-TUFF CORPORATION

DEPT. 10, BOX 275, HUNTINGTON, L. I., NEW YORK

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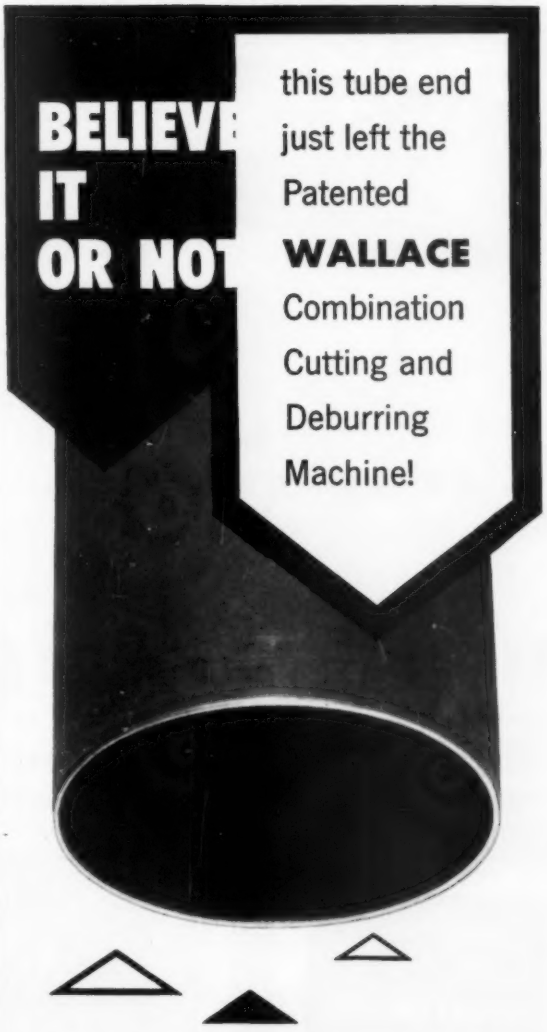

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. . . and you can do it in your own shop for lowest ultimate cost.

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Cutting and bending. 200 pages — 148 illustrations. Answers thousands of troublesome shop questions. $3.00 plus 30¢ mailing cost. Send cash and save 30¢ postage.

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Circle No. 45 on Reader Service Card.

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MANGALLOY

FOR BUILD-UP AND STRENGTH

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WELDING ELECTRODES
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APPLICATOR BARS
and CAST DIPPER TOOTH
REPOINTERS

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New York 13, N. Y.

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ACRO
WELDER MFG. CO.
MILWAUKEE

WELDING ENGINEERS

MACHINERY BUILDERS

ESTABLISHED
1936

Circle No. 2 on Reader Service Card.

Inert Arc Torches

A new water-cooled torch rated at 500 amps has been developed by K-G Equipment Company for inert arc welding. Called W7-500 Vis-Arc, torch has ⅛-inch water passages for better cooling and flow, virtually eliminating mineral deposit buildup in tubes. Another feature: Heat-break fiberglas washer between the nozzle and the silicon rubber insulated head. Torches are said to be durable, well balanced, easy to maintain and give full gas shielding.

Circle No. 186 on Reader Service Card.

Portable Screen

This portable screen from the Special Products Division of Singer Glove Mfg., Company seems to be just what industry has been waiting for. The unit is ideal as a welding shield or a dividing partition for grinding or other machines where protection is imperative.

Exclusive slip-joint construction makes assembly a five-minute job. The light-weight unit is available in stock sizes up to 6x8 ft.

Circle No. 159 on Reader Service Card.

Flexible Welding Mirror

The new Permatain welding mirror is said to make it possible for a welding operator to see what he is doing in difficult-to-reach or hidden places.

The stainless steel mirror can be adjusted and positioned with ease. It is mounted on a flexible metal tube which has a moveable magnetic base (two magnets set on a common shaft).

Circle No. 187 on Reader Service Card.

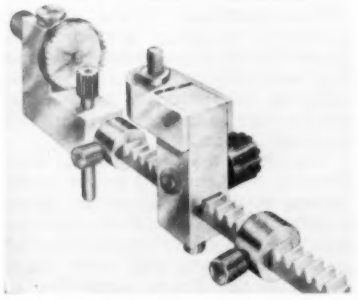
Aluminum Welding Wire

A new bright finish welding wire especially developed by Kaiser Aluminum to insure high strength welds, is now available as spooled welding electrodes or as straight rods.

These welding electrodes and rods, in the magnesium-bearing aluminum alloys (5154, 5183, 5254 and 5356), are processed to provide a filler wire surface that is essentially free from heavy oxide formation and low in hydrogen containing compounds. The wire so produced is said to minimize porosity in welds and insure greater soundness and strength in all types of aluminum welded joints.

The two new King brand products are made from bright finish aluminum wire. Electrodes for consumable welding are regularly furnished in one and ten pound non-returnable spools. For those companies using tungsten arc welding equipment, 36-inch straight length rods are available. Both spooled electrodes and straight rods are furnished in a broad range of alloys, including the new filler wire alloy 5183.

Circle No. 60 on Reader Service Card.



Circle Guide

The Heath Engineering Company has introduced a new attachment for their Ultra-Graph guidance machines for guiding the cutting and welding of circles without templates or patterns. The CA-30 attachment adjusts to any diameter up to 44" in seconds when mounted on the tracing head of the machine. It locates quickly over a predetermined mark anywhere on the plate.

Circle No. 158 on Reader Service Card.

Control Boom Telescopes

A compact carrier-cart with telescoping boom to move welding control and wire-feed unit to the weld area, has been introduced by the National Cylinder Gas Division of Chemetron Corp. The boom, raised and lowered by a 2½-ton hydraulic pump, can be adjusted to heights from 4' to 14' and rotated 360 degrees. Good for large maintenance operations and shops with limited crane service.

Circle No. 157 on Reader Service Card.

more new products on 111

ELECTRIC-ARC INC.

One of a Series on Applications of Electric Arc's Smith-Dolan Units — Today's Most Versatile Heat-Treating Tools.

STOP WELD FAILURE *with the* SMITH-DOLAN SYSTEM *of Low-Frequency Induction Heating*

Here is the versatile heat-treating tool you need for producing sound welds easily and economically in carbo-alloy and other types of steel pipe . . . here is precision control of heating cycle when pre-heating and stress relieving — uniform, through-and-through heating of solid sections up to two feet thick and more — pushbutton operation — complete portability for on-the-job heat treating anywhere.

Many Money-Saving Applications — The Smith-Dolan System simplifies and upgrades work quality in numerous applications ranging from welding to forming and annealing. Units are available for 60 cycle heating in capacities ranging from 10 to 150 KVA . . . for 400 cycle heating . . . resistance heating. Pre-engineered with complete instrumentation, accessories.

"On Trial" Installations on Rental Basis — Prove the many Smith-Dolan advantages in your own plant without capital investment. Write, wire or phone.

Electronic recording gives permanent charts of heat run on this standard Smith-Dolan model. Coils permit work at 50 feet or more from unit. Eye hooks provide for easy handling by crane. Products ranging from a fraction of an inch to 10 feet in diameter can be heat treated on the job.

New Brochure — Send today for your copy of "Smith-Dolan System of Low-Frequency Induction Heating."

Electric Arc, inc.

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Representatives in Principal Cities

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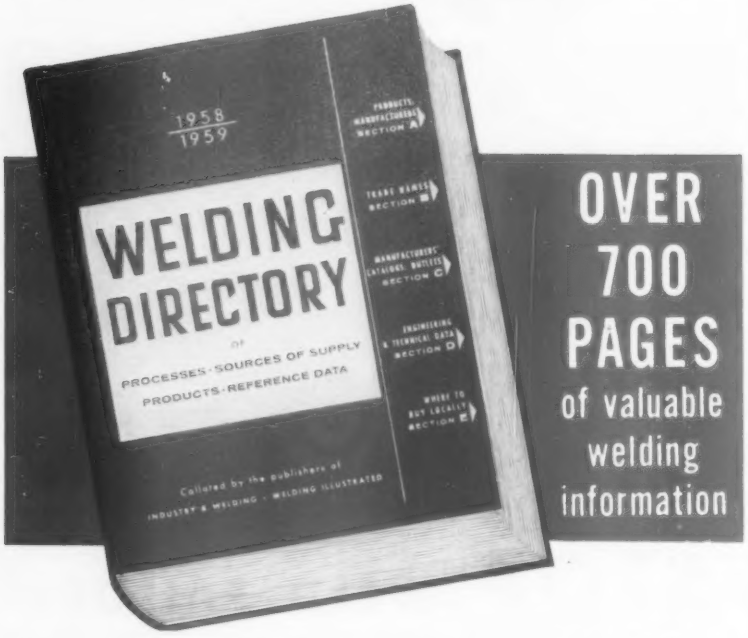
AVAILABLE FOR THE FIRST TIME!



YOUR GUIDE to Better Welding

New and complete, already the most widely used buyers' guide in the welding industry.

The 1958/1959 Welding Directory has 680 pages of facts for buyers between its handsome cloth covers. You'll find more than 350 products listed, 1700 trade names, 2000 distributors.

Special feature: a 256-page technical and engineering data section. Manufacturers' catalogs and sales outlets put sources at your fingertips.

FIVE CONVENIENT SECTIONS

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- Trade Names
- Manufacturers' Catalogs & Sales Outlets
- Technical & Engineering Data
- Where To Buy Locally

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812 HURON RD., CLEVELAND 15, OHIO

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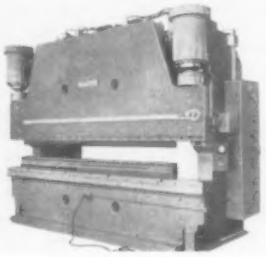
City: ..... Zone: ..... State: .....

Portable Spot Welder

Adams Portable Spot Welder has completely redesigned their unit so that all connections and controls are in one easy-to-read panel. The welder, with basic transformer and air or water-cooled guns (in six types), was designed for sheet metal welding and tight spot work. High transformer efficiency and highly conductive copper fittings combine to give maximum weld current.

Circle No. 188 on Reader Service Card.



Hydraulic Press Brake

The Cleveland Crane and Engineering Company has announced a new line of press brakes for bending mild steel. Steelweld presses come in capacities up to 2000 tons for bending 10 gauge to 2-inch stock, up to 30 feet in length.

Important features are: no overloading, long constant power stroke, reversing ram, adjustable stroke length, two speeds, fast approach-quick return, operating pressure adjustment, always-level ram, taperable ram and simple operation.

Circle No. 189 on Reader Service Card.

Pipe Flange Line-Up Pins

A new device, designed to simplify accurate alignment of bolting flanges before they are welded to pipe, has been developed by C. A. Mathey Machine Works, Inc. Used in pairs, line-up pins will center in ¼- to 1¾-inch bolt holes by simply slipping their two parts together; lever releases them for removal. A spirit level laid on the two pins shows when the bolt holes are exactly horizontal.

Circle No. 190 on Reader Service Card.

Portable Nibbler

Modern Mfg. Co. has developed a new portable nibbler that will cut woven wire, wire cloth, and $\frac{3}{16}$" gasket. The unit can be used as a portable or mounted tool.

The unit which cuts sheet metal without distorting it comes in models that will cut to $\frac{3}{32}$" or $\frac{3}{16}$" wire. The unit operates on 110 volt, AC or DC.

Circle No. 191 on Reader Service Card.

REFERENCE DATA

catalogs, handbook, manuals

RESISTANCE WELDING CASE HISTORIES are described in a 12-page, illustrated bulletin, Volume 5, No. 3 "Resistance Welding At Work", published by Sciaky Bros., Inc. Flush surface fastening, automatic fixture and seam welder for fin welding, and the advantages of flash-butt welding are a few of the detailed descriptions covered. **Circle No. 130 on Reader Service Card.**

X-RAY ANALYSIS THEORY & INSTRUMENTATION is the title of a new 12-page booklet available from the Instruments Division, Philips Electronics, Inc. Text covers principles of operation and uses simple diagrams to illustrate the basic differences between: Film Diffraction, Diffractometry and Spectrography. Industrial applications and user lists are included. **Circle No. 131 on Reader Service Card.**

CYLINDER MANIFOLD catalog, Form 14, is a 24-page, illustrated book published by National Welding Equipment Company, which describes the advantages of their Compound Pressure design. Screw assembly of stock parts (no soldering) with two open end wrenches means the manifold can be assembled or disassembled, or extended, at will. **Circle No. 132 on Reader Service Card.**

LINE OF TORCHES that can be used interchangeably with every fuel gas combination—oxy-acetylene, oxy-propane and oxy-natural gas—are described in an illustrated 6-page folder just printed by Linde Company, Division of Union Carbide Corporation. Also, folder covers manual and machine cutting equipment for use on thin sheet to 10-foot thick jobs. **Circle No. 133 on Reader Service Card.**

INERT GAS WELDING TORCHES and tungsten electrodes are the subject of a complete, 16-page catalog VA 58, published by The KG Equipment Company, Inc. Seven Vis Arc torch types are listed as to recommended uses, specifications, parts list and advantages. Useful selection and comparison charts are also included. **Circle No. 134 on Reader Service Card.**

SIMPLIFIED PREHEATING AND STRESS RELIEVING with induction heating is the subject of folder DM-74 prepared by Hobart Brothers Company. A 400-cycle generator which supplies AC to a wire induction heating coil, automatically operated by an Electronik Strip Chart Program Controller, is described. This means automatic control, and a chart record of all program phases. **Circle No. 135 on Reader Service Card.**

MECHANICAL PRESSES. Single Action, Straight-Side, Single Crank Presses in capacities from 60 to 400 tons are featured in a new eight-page bulletin published by The Federal Machine And Welder Company. **Circle No. 136 on Reader Service Card.**

MANIFOLD INFORMATION is contained in a new 24-page catalog (#829) entitled "Manifolds for Gases" published by Air Reduction Sales Company. Details and illustrations describe cylinder capacities, cylinder arrangements and dimensions and the advantages of manifolding. Feature attraction of the catalog is the announcement of the new Deluxe Stationary Duplex type. **Circle No. 137 on Reader Service Card.**

STEP-BY-STEP REPAIR of welding and industrial regulators is the useful information supplied in Modern Engineering Company's new bulletin. It tells how to install new seats properly, to reduce repair charges and down-time, is explained. **Circle No. 138 on Reader Service Card.**

CLAMPING AND BENDING ACCESSORIES designed for use with their Welding Platens or Bending Blocks are described in a brochure published by Acorn Iron & Supply Company. Called Bending Post and Horizontal Clamp, aids are described as a real help to clamping and bending. **Circle No. 1 on Reader Service Card.**

FACTS AT YOUR FINGERTIPS: *If you want copies of the catalogs featured on these pages, just circle the appropriate numbers on the bound-in Reader Service Card. We'll do the rest.*

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You Can Weld Dissimilar Alloys Easily

INCO-WELD "A" ELECTRODE
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INCO-WELD "A" WIRE
FOR INERT GAS (MIG & TIG) WELDING

Get strong, sound welds joining combinations of

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for ECONOMY
for SPEED

Models: SA-10-P1 • SA-25-P1
SA-40-P1 • SA-50-P1

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- Capacity 1,000 up to 5,000 lbs.
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- Thyratron control
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- Infinitely variable from 0 to 2 rpm
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- Rapid acceleration from 0 to maximum in .07 seconds
- Positive stops
- Remote control switch
- Reversible
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FEATURES OF VARIABLE DRIVE:

SPEED STABILITY: Under all load, line voltage and temperature conditions.
CONTROL HEAD: Load change up to 50% results in speed change less than ½% of rated speed.
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BI-DIRECTIONAL OPERATION: Speed in either direction is within ½%.
ROTATIONAL POWER: Hardened, ground steel worm and bronze worm wheel drive.
TACHOMETER READING: Tachometer reads in surface speed.
MOTORS: Ball bearing, drip-proof, with balanced armatures and magnetic brakes.

THE WELDMA COMPANY
62 LaSalle Road
West Hartford, Conn.

Circle No. 114 on Reader Service Card.

USEFUL LITERATURE *continued*

OPTICALLY CORRECT MASK GOGGLE, which keeps flying particles from striking from any direction, is described in an illustrated, punched-hole catalog sheet made available by American Optical Company. Made of light, flexible (comfortable) vinylite, the new 482A goggle is feature attraction, but details about their chemical goggle and goggle with filter lens adapter, are also given. **Circle No. 139 on Reader Service Card.**

DRY ABRASIVE CUTTING MACHINE, Model 1-A Sever-All, is described in a 4-page tells-all folder, DH-106, issued by the Allison-Campbell Division, American Chain & Cable Company. Specifications for this and weights and dimensions are listed. **Circle No. 8 on Reader Service Card.**

NEW DESIGN CONCEPT for chipping hammers is described in literature available from Ingersoll-Rand. Illustrated Bulletin, Form 5229, outlines the advantages of their new Shock-Absorber line which: is more comfortable and efficient; cushions chisel in cut; absorbs chisel vibration; drops noise level; and eliminates maintenance due to improper operation. **Circle No. 140 on Reader Service Card.**

CORRESPONDENCE TRAINING COURSE entitled Welding Fundamental Principles and Practices is the subject of a folder published by National Technical Training Services. Course, which consists of 16 lessons and lasts about 10 months, is ideal for supervisors, engineers, operators . . . teaches methods, controls, design, estimating and costs . . . closes with supervised examination. **Circle No. 141 on Reader Service Card.**

COMPLETE SPECIFICATIONS covering a multi-low-range universal tester is described in illustrated literature, Bulletin 9E, from W. C. Dillon & Co., Inc. The motorized lab instrument (comes in hand wheel bench model too) for testing materials up to 300 lbs., is very accurate (½ of 1%) and features an automatic stress-strain recorder, over-run limit switch and maximum applied load indicator. **Circle No. 142 on Reader Service Card.**

WHEN IS A CATALOG A TEXTBOOK? When, like the 400 item clamping tool catalog published by Wilton Tool Mfg. Co., Inc., it contains application, construction and specification data in a color indexed, easy-to-read form, drawings and photos to illustrate, and a lot of information on the latest developments on clamping manufacture and use. **Circle No. 143 on Reader Service Card**

FULL-ENCIRCLEMENT SADDLE . . . a stronger . . . safer . . . longer lasting reinforcement for branch connections, is the way Bulletin TT866, published by Tube Turns, describes their new piping product. Reasons for the development of the single and multi-branch types, cyclic life compared to ordinary saddle reinforced types, strength, specifications and sizes, are included. **Circle No. 144 on Reader Service Card.**

WANT CIRCLES, RINGS, IRREGULAR SHAPES? Joseph T. Ryerson & Son, Inc., tells you how they can supply them economically, in steel of any thickness—carbon, alloy and stainless steels—in their revised bulletin on flame cut products. Facilities include multi-torch setups guided by electric eye equipment. **Circle No. 145 on Reader Service Card.**

7000 LBS. PLUS BENDING POWER for bending metals up to $\frac{3}{16}$" by 2" is the J. A. Richards Company story in Circular R-60 about their Multiform No. 6 Hydraulic bender. Specifications for the fast acting bender which can make a bend of any shape (26 dies included), are given. **Circle No. 146 on Reader Service Card.**

VARIABLE VOLTAGE TRANSFORMERS (Heavy Duty) in the 5 to 41.5 KVA range are the subject of a four-page bulletin released by the M & T Welding Products Corp. Design and construction characteristics are illustrated by exploded views and schematic diagrams for both single and three phase transformers. Specs are there too. **Circle No. 147 on Reader Service Card.**

continued

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Capacities up to 10,000 lbs. Steel axles —any width. Axle . . . with hubs, bearings, grease seal and grease caps. Springs . . . with saddles, U-bolts, shackles, spring bolts and bracket assemblies. Wheels . . . all sizes.

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Includes new HAMMER BLOW Jack with sensational swivel feature that permits jack to be swung parallel to tongue for maximum ground clearance.

Two Models—
No. 61FDS with gear and rack movement and side mounted crank,
No. 51FDS with screw type movement and top mounted crank.

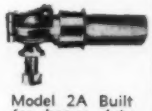
New BULL DOG Screw-type Top Crank Jack. Adjustable clamping bolts adaptable to channel, angle or wood tongues up to 4" thick. Three Models—disc foot, steel wheel, and hard rubber wheel.

For interchangeable mounting, easily installed and transferred from one machine to another. Three Models—with disc foot, steel wheel, and hard rubber wheel.

BULL DOG COUPLERS

Model 44A with Pressed steel tongue-end . for welding or bolting to straight steel or wood tongue. Length 16½", shipping weight 12 lbs.

Farm implement and wagon couplers—from the smallest to 10 ton sizes. Two Models illustrated here.



Model 2A Built for heavy duty farm use, crafted in drop forged steel. 5" long, shipping weight 11 lbs.

SPINDLE END ASSEMBLIES

Complete Spindle End Assemblies for 2,500, 4,000 and 5,000 lb. capacities Per Pair. Available in complete assemblies or individual parts—Spindle Ends, Hubs, Wheels.

Contact our engineering department for full details on your particular application—a FREE service to you—write for Catalog 18P.

HAMMER BLOW TOOL CO.
WAUSAU · WISCONSIN

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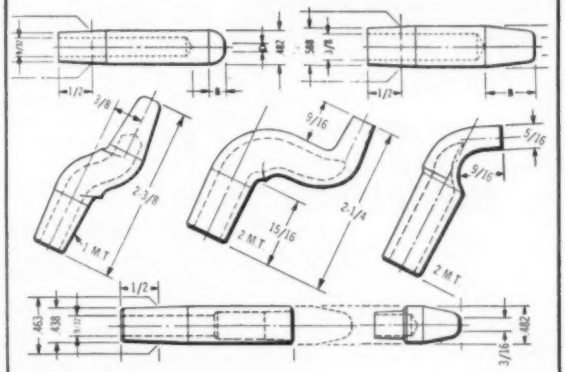
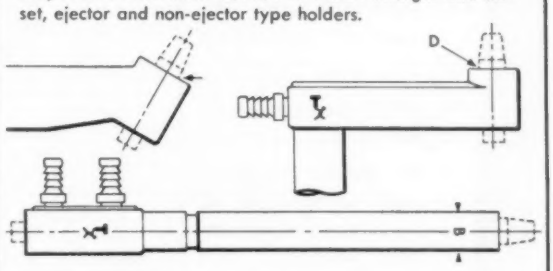
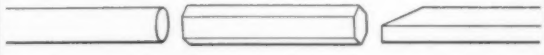


TIPS, ADAPTERS and HOLDERS. Replaceable tips in No. 1, 2 and 3 Morse taper, all dimensions conforming to R.W.M.A. standards. Adapters in No. 1 and 2 Morse taper. Special shapes and sizes manufactured to order. Straight and offset, ejector and non-ejector type holders.



FORGINGS, DIES. Forged rectangular, square or special shapes, such as seam welder shafts and bushings, made to order. Forged or machine finished projector welder dies, barrel and flash welder dies, welder arms, special electrodes, furnished to your specifications.



BAR STOCK. Round, hexagon, and rectangular bars for fabrication of electrodes, platens, adapters, and other special needs.

CASTINGS. Cast electrodes, welding machine bushings, welder arms, dies and fixtures, with or without cast-in water cooling holes, made to your specifications.

SEAM WELDER and TUBE MILL WHEELS. Forged or rough machined wheel blanks and machine finished wheels made to order. Stock sizes of machined blanks. Replaceable rings for tube mill wheels.

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Resistance Welding Alloys

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Visit our booth #422 at the National Metal Exposition & Congress in the Cleveland Public Auditorium, October 27-31.

Circle No. 102 on Reader Service Card.

USEFUL LITERATURE *continued*

LOW FREQUENCY INDUCTION HEATING is the subject of a new brochure published by Electric Arc Inc. The versatility of the Smith Dolan heat treating system is discussed.
Circle No. 35 on Reader Service Card.

INDUSTRIAL RADIOGRAPHY is the story told in an interesting 16-page brochure available from Curtiss-Wright Corporation's Princeton Division. Featured is a complete line of equipment and accessories for use in isotope radiography. Brochure tells how to choose a source, how to calculate and make exposures and how to use a variety of cameras.
Circle No. 148 on Reader Service Card.

A STEEL HARDENING COMPOUND that is said to make ordinary steels do the work of costly, high-carbon alloys is featured in literature from Hard-N-Tuff Corp. Step-by-step instructions are given for use of the compound which makes tools and parts treated last as much as 40 times longer and is guaranteed to produce 60 Rockwell C even on low carbon steel.
Circle No. 52 on Reader Service Card.

GENEROUS FLUX SAMPLES are available from Krembs and Company which manufactures 25 different fluxes. Write for yours on company letterhead. Use reader service card for literature.
Circle No. 64 on Reader Service Card.

AN AIR-COOLED ELECTRODE HOLDER is the subject of literature from J. B. Nottingham & Co., Inc. Literature explains how low pressure air system permits use of high welding currents, high duty cycles and use of large electrodes (through $\frac{5}{16}$-inch at maximum current).
Circle No. 80 on Reader Service Card.

A PRECISION WELDING POSITIONER developed by the Weldma Company for use on complicated weldments of titanium and other super alloys is described in a 4-page brochure. Dimensions and design details are given.
Circle No. 114 on Reader Service Card.

TUNGSTEN CARBIDE SURFACING is explained in a 4-page bulletin issued by Kennametal, Inc. Described and illustrated is a new wear-resistant product which consists of small hexagonal carbide buttons assembled on a flexible backing material for bonding on metal surfaces.
Circle No. 32 on Reader Service Card

GAS CUTTING MACHINES are featured in an 8-page catalog offered by American Messer Corp. Described and illustrated are a variety of standard and heavy-duty units. A complete line of accessories, including manual tracing heads, magnetic heads and automatic leveling devices, are featured.
Circle No. 14 on Reader Service Card.

RESISTANCE WELDERS specifically designed for the sheet metal, wrought iron, wire fabricating and tubing industries are the subject of a 4-page catalog from Alphil Spot Welder Mfg. Corp. Described and illustrated are flash, projection, butt, spot and gun welders.
Circle No. 11 on Reader Service Card.

PORTABLE SPOT WELDERS are the subject of illustrated literature from Aro Spot Welders Division of Guthery Machine Tool Corp. Literature explains important, new "ski lift" gyro suspension.
Circle No. 20 on Reader Service Card.

REINFORCED RESINOID products are the subject of a complete 18-page catalog from Bay State Abrasive Products Co. Complete information is given on selection and use of raised hub disc wheels, reinforced resinoid straight wheels and abrasive cut-off wheels.
Circle No. 149 on Reader Service Card.

POWER PRESSES are the subject of 20-page Warco Bulletin 52151 issued by Federal Machine and Welder Company. Bulletin describes and illustrates various presses and tells when to use which. Included are fundamentals of press working of metals. Sketches, tables and charts illustrate the book.
Circle No. 150 on Reader Service Card.

A MECHANICAL DRAFTSMAN for contouring pipe up to 24-inches in diameter without cams or templates is described in literature from Steffan Engineering. Also featured is a mechanical hole cutter. Both tools use an oxy-acetylene flame.
Circle No. 90 on Reader Service Card.

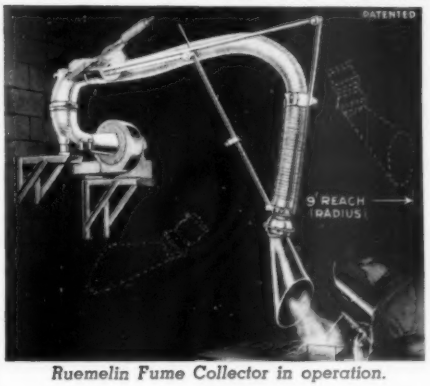
LIFTING AND POSITIONING CLAMPS made by J. C. Renfroe & Sons, Inc., are the subject of an illustrated 14-page catalog. Described in detail is special "safety snap lock" which holds plates or assemblies securely yet snaps open for easy removal.
Circle No. 84 on Reader Service Card.

NEW HARD FACING FACT FILE offered by Metal & Thermit gives helpful data on company's Murex line of 88 types and sizes of Hardex hard surfacing electrodes and rods. Complete data for reference files is listed on convenient 3-by-5 cards which provide finger tip access to information.
Circle No. 72 on Reader Service Card.

continued

Circle No. 87 on Reader Service Card.

REMOVE WELDING FUMES at the Source— with RUEMELIN FUME COLLECTOR



Ruemelin Fume Collector in operation.

Welding shops equipped with Ruemelin Fume Collectors are assured of a clean shop atmosphere. Noxious fumes, heat and smoke are eliminated AT THEIR SOURCE. Improves working conditions . . . lessens fatigue . . . paves the way for increased plant production. Especially helpful in winter months when windows and doors are closed. Note the new spring-loaded counterbalance mechanism which makes Fume Collectors much easier to handle. Ask for Bulletin 37-E illustrating this new feature.

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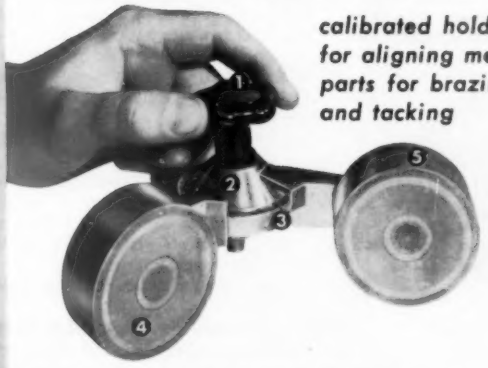
NOW! 2 new aids for faster, easier cutting and welding

PERMATAIN *magnetized*
ANGLE HOLDER

calibrated holder for aligning metal parts for brazing and tacking

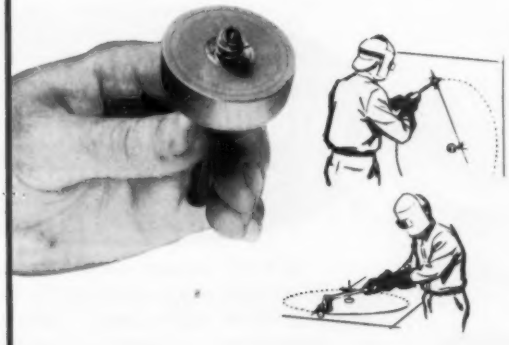


1. Plastic knob for locking at any angle
2. Easy-to-read calibrated scale (with vernier)
3. Direct stop at 90°
4. Magnetic blocks resist temperatures to 600° F.
5. No magnetic fields on top or side of blocks

CAN BE SET AT ANY DESIRED ANGLE

PERMATAIN *magnetized*
CENTER FIXER

for fast, easy circular cutting



- Use in horizontal or vertical position
- One-man operation
- Use on sheet steel, floor plate or grating steel
- No magnetic fields on top or side
- Magnets resist up to 600° F.
- USA Patent 2,781,582

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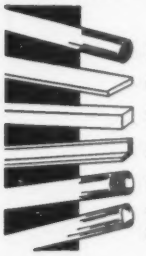
Circle No. 56 on Reader Service Card.

1 MAN + 1 BENDER

Bends all these:



ROUNDS
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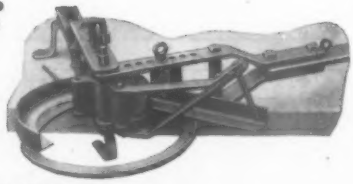
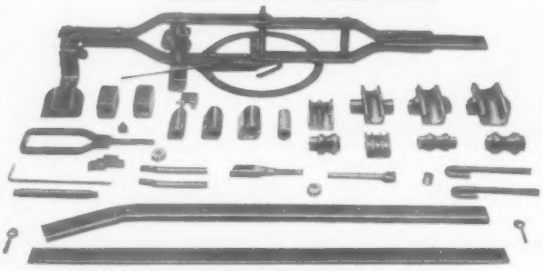
TUBING & CONDUIT



HOSSFELD
UNIVERSAL® IRON BENDER
35 Years Bending Experience

- Wrenchless, ready to use.
- Practical, quickly set up.
- Adaptable, replaces special equipment.
- Versatile, 143 different dies available.
- Dependable, a "must" for maintenance, limited production.
- Invaluable, optional equipment makes jobs easier.



BENDER SHOWN WITH REGULAR EQUIPMENT

FREE: WRITE FOR BULLETIN.

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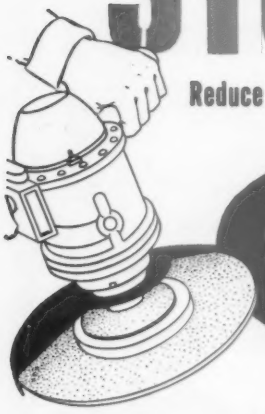
STOP COSTLY ACCIDENTS

Reduce Insurance Costs • Cut Time Loss • Save Lives!



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STANDARD WHEEL GUARDS
. . . on your portable tools

STOP costly accidents with MORRISON Standard Wheel Guards! Safety codes and laws REQUIRE guard protection. Specify MORRISON for maximum safety . . . lighter weight . . . lower cost . . . greater strength. Full protection for operator with minimum interference with work.

Remember, MORRISON also makes revolving cup guards. There is a MORRISON Guard for every application . . . all are made to comply with American Standard Safety Code.

SEE YOUR GRINDING WHEEL SUPPLIER OR WRITE:

MORRISON PRODUCTS INC. 16816 Waterloo Road Cleveland 10 Ohio

Circle No. 77 on Reader Service Card.

ERECTOR SET TOOLING known as the Wharton Universal Jig & Fixture System, is described in literature available from Wharton Unitools. Case history describes how G.E. used this system, consisting of 450 interlocking blocks, clamps, bolts, bushings, and other parts which can be assembled in any combination, in cost-saving jigs and fixtures for small lot machining and assembly.
Circle No. 151 on Reader Service Card.

SURFACE HARDENING and heat treatment compounds are the subject of a booklet available from Kasenit Company. Kasenit No. 1 and No. 2 are described as effective hard, wear-resistant case producers for mild steel, alloy steel, cast or tool steel. Applications, instructions and prices are included.
Circle No. 61 on Reader Service Card.

OPPORTUNITY for small shops to increase profits through automatic welding, is discussed in a four-page, illustrated reprint available from C. B. Herrick Mfg. Corp. Welding equipment, including ram manipulators and welding fixtures, are described in case histories.
Circle No. 152 on Reader Service Card.

CABLE CONNECTION vulcanizing kit is the subject of a new 4-page catalog #131-B made available by Cam-Lok Div., Empire Products, Inc.
Circle No. 29 on Reader Service Card.

A COMPLETE FAMILY of electrode holders is featured in a catalog from Duro Engineering Co. Described and illustrated is the new line of Durogon holders. Design details are given and parts list is included.
Circle No. 33 on Reader Service Card .

METALLIZING WIRE TABLE for industrial spray application is available from the Spra-Rod Corporation. The table lists the wire by type, size, and price.
Circle No. 154 on Reader Service Card.

COMPLETE LINE OF HYDRAULIC PRESS BRAKES is described and illustrated in a 2-color catalog available from The Cleveland Crane and Engineering Co. Features and specifications are listed.
Circle No. 155 on Reader Service Card.

HOW TO USE NICROBRAZ 50 is described in a two color engineering data sheet (No. 22) available from the Stainless Processing Division of Wall Colmonoy Corporation. Data sheet itemizes both engineering and metallurgical properties.
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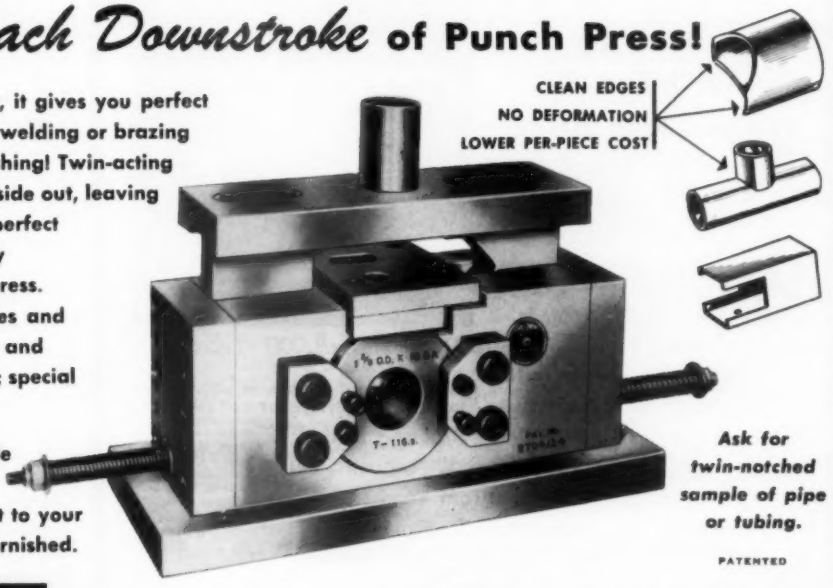

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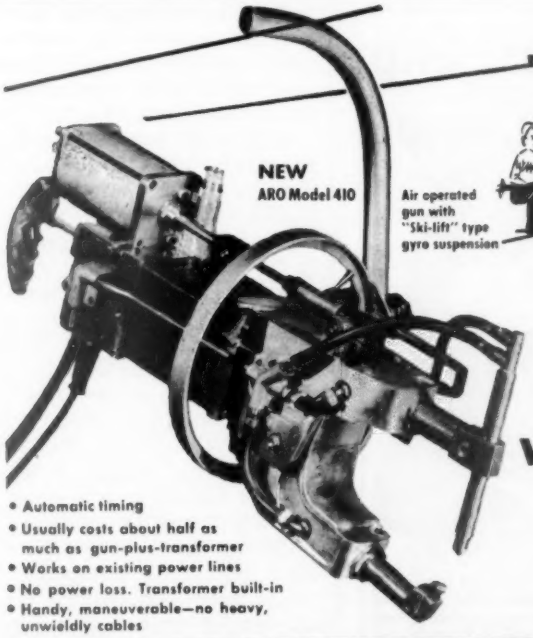

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should be used to control the duration of flow. A gas solenoid saves gas, while the water solenoid prevents moisture condensation on the torch nozzle.

Use just enough gas to maintain effective coverage. Excessive gas flow-rate is not only wasteful, but can be detrimental. It can cause an unstable arc condition (at low current values) and under-cutting.

Minimum gas flow depends on 12 things: the type of shielding gas used, the geometry of the weld joint, the distance of the gas nozzle from the work, the size of the nozzle, the shape of the nozzle, the size of the puddle, the amount of welding current necessary, the presence of air current or drafts, the position of the work piece, the design of the fixture, the welding speeds and the inclination of the torch.

The choice between argon or helium must be made on basis of the particular advantages of each:

Argon gives superior oxide cleaning action with AC on aluminum, magnesium and beryllium - copper. Generally, it's more desirable for use on materials which have a tendency to form tough oxide surfaces.

Argon is recommended for manual operations because changes in arc length will not produce as great a change in arc voltage and ultimate heat input to the work as does helium. Argon has other advantages: It gives a softer arc. It gives less penetration so it is generally more suitable for thinner materials. It can be used with less accurate joint fit-up. It contributes to easier arc starting at lower current values. It is suitable for making overlays and for welding dissimilar metals.

Helium on the other hand, is used more with automatic and mechanized applications where arc length control is no great problem. It yields better penetration than argon because of its inherent 40 percent greater heat per unit length of arc. Further advantages are these: It is better on certain aluminum casting-alloy applications for reducing

weld porosity. It gives increased welding speeds. It gives a more stable and hotter arc with DC straight polarity. Because of the hotter arc and faster welding speed, the effect of heat on the work is minimized. Helium is more desirable for work with high heat conductivity.

When helium is used to get certain desirable bead crown characteristics in thin materials at currents below 10 amps, it may be necessary to start the arc with argon and then switch to helium. It is virtually impossible to start arcs in helium where current values are 0.5 to 10 amps.

Helium-argon mixtures give the benefits of helium's penetrating ability and argon's soft arc and ease of control. A 75 percent helium-25 percent argon mixture gives nearly the equivalent cleaning action of straight argon on balanced wave AC. It helps control porosity, particularly in aluminum castings. It also gives the deeper penetration with the great heat input associated with helium. With DC straight polarity, the 75-25 mixture gives characteristics similar to straight argon. Mixing in any proportions can be done with appropriate mixing equipment to obtain any arc characteristics desired.

PART 2, January, 1959, discusses power sources and current types.

COMING EVENTS

October 27-28, 1958: N.W.S.A. West Central Zone Meeting, Hotel Muehlebach, Kansas City, Missouri.

October 27-31, 1958: National Metal Exposition and Congress, Cleveland Public Auditorium and various hotels, Cleveland, Ohio.

October 30-31, 1958: N.W.S.A. Western Zone Meeting, Riviera Hotel, Las Vegas, Nevada.

December 1-2, 1958: N.W.S.A. Southeastern Zone Meeting, Dinkler-Tutwiler Hotel, Birmingham, Alabama.

December 4-5, 1958: N.W.S.A. Southwestern Zone Meeting, Statler Hilton, Dallas, Texas.

January 26-29, 1959: Plant Maintenance and Engineering Show, Cleveland Public Auditorium, Cleveland, Ohio.

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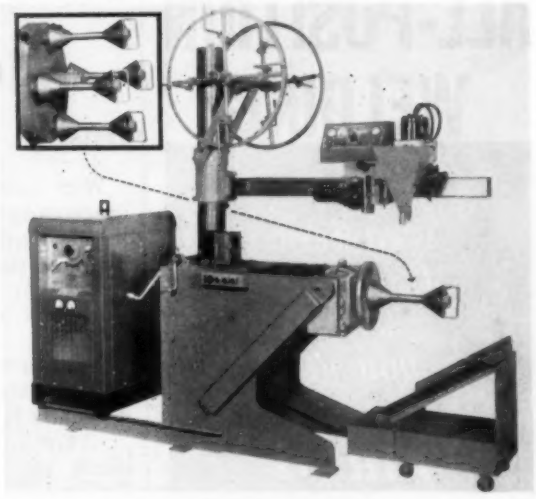
For Fabrication Welding, Rebuilding and Hard-facing Heavy Earth-Moving and Industrial Machine Parts — The 2890-D Automatic Welding Machine designed by Auto Arc — complete with Auto Arc welding head, controls and welding source.



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40th Metal Show keynote: make it better with metals.

With industrial activity again quickening and world events intensifying the need for scientific progress, the 40th National Metal Exposition and Congress at Cleveland, Ohio, October 27-31, will play a major role in the 1958 metalworking drama.

Theme this year for the Show is "Make It Better With Metals . . . For Less." Nearly 500 exhibits are expected to occupy 300,000 square feet of floor space in Cleveland's Public Auditorium.

"Technical presentations of the American Society for Metals and seven cooperating groups will be outstanding in scope and scientific depth" reported ASM Assistant Secretary Bayless.

Hours for the Metal Show in the Cleveland Public Auditorium will be Noon to 10:30 p.m. on Monday, Tuesday and Wednesday, October 27-29, and 10:00 a.m. to 6:00 p.m., Thursday and Friday, October 30-31.

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National Carbon Co.
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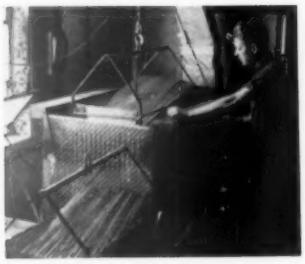

CLEANLINESS is key as . . .

All-State Builds West Coast Plant

A new plant for the manufacture of aluminum welding wire, rods and electrodes will be established on the West Coast by All-State Welding Alloys Co., Inc. Announcement was made by Thomas D. Nast, president, who said the plant would be located at 4933 Firestone Blvd., South Gate, Calif.

At the same time, Mr. Nast announced that a 5,000 square foot wing had been added to the company's White Plains, N.Y., plant. The wing will accommodate the company's shipping department in which new processing equipment had been installed.

Linde Opens New Hydrogen Plant

Linde Company, Division of Union Carbide Corp., is now operating a new high-purity hydrogen plant at Linden, N.J. According to Linde's president, W. M. Haile, the plant will meet growing industry needs in the metropolitan area.

Air Reduction Builds At Kansas City, Kansas

A new oxygen and nitrogen producing plant in the Armourdale district of Kansas City, Kansas, is being built by Air Reduction Sales Co. The new plant will serve users in a 300 mile radius of Kansas City. It will have a monthly capacity of 5 million cubic feet of oxygen and will also produce high purity nitrogen

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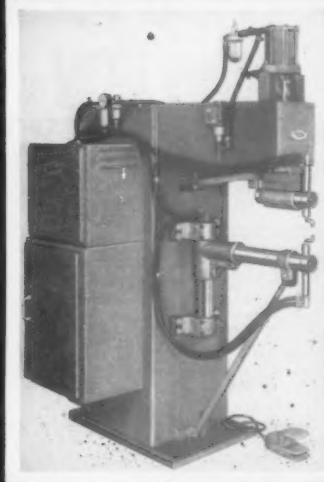

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LIQUID GAS is news as . . .

Liquid Carbonic Opens Two West Coast Plants

Two new industrial plants, one for the manufacture of liquid oxygen, nitrogen and argon and the other for the manufacturer of electrolytic hydrogen and oxygen, have been dedicated in the San Francisco area by Liquid Carbonic Division of General Dynamics Corp.

The two new installations are located in Oakland and San Carlos. They bring Liquid Carbonic Division's overall investment in the Bay Area to 7½ million dollars.

A.W.S. Forms Section at Nashville, Tenn.

The formation of a new section at Nashville, Tenn., has been announced by the American Welding Society. An official charter was authorized by the Society's Board of Directors when requirements were met.

The new sections brings the total of A.W.S. section to 81 and is the fourth in Tennessee.

A.W.S. Presents Third Davis Award

A new yearly award for the best contribution in the field of maintenance and hard surfacing has been announced by the American Welding Society. A silver medal and certificate will be awarded annually to each author of the best paper published in The Welding Journal on maintenance and hard surfacing.

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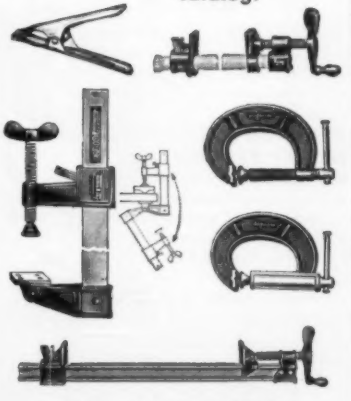

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